TEST EDITION

THE TEXTBOOK OF

COMPUTER SCIENCE

For Grade 9

SINDH TEXTBOOK BOARD, JAMSHORO

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Prepared by **ASSOCIATION FOR ACADEMIC QUALITY (AFAQ)** for SINDH TEXT BOOK BOARD JAMSHORO.

Reviewed by Provincial Review Committee Directorate of Curriculum Assessment and Research Sindh Jamshoro (DCAR).

Prescribed as a Textbook by the **Boards of Intermediate and secondary Education, Karachi, Hyderbad, Sukkur, Larkana and Mirpurkhas** for Secondary School Certificate Examination in the Province of Sindh.

Approved by the **Education and Literacy Department, Government of Sindh.** No. SED/HCW/181/2018 Dated 22-7-2020 for the province of Sindh.

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Printed at:

PREFACE

The New Textbook of Computer Science for Grade 9 is in your hand. This book is written on the Reviewed Curriculum of Computer Science 2018 by Directorate of Curriculum, Assessment and Research Sindh, Jamshoro. It took some time to develop and publish this book. No doubt that Textbook of Computer should be revised frequently and this is what STBB commits now with all the stakeholders.

I hope that this book will be helpful for teachers to impart latest knowledge and skills in students. This book will meet the diverse needs of students at large. Computer Science Textbook discourages rote learning and promotes performance based skill development for students. Readers of this book will find and appreciate the rigorous effort to promote critical thinking, creativity, analysis and self-learning.

The world is changing rapidly. To compete with the world we need to equip our youth with IT skills. Teachers bear this responsibility and do their best to offer academic excellence. This textbook will be a great tool for teachers in this regard.

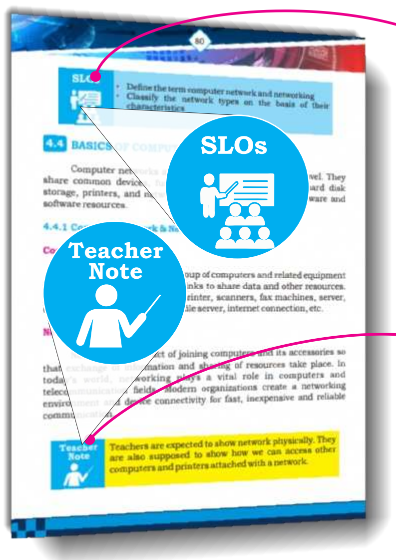
Our organization is indebted to all the Authors and Reviewers of this book who made rigorous efforts to deliver a book that is competitive with any other textbook at this level.

We encourage teachers, students, parents, researchers and all the stakeholders to give their feedback and suggestion to further improve this book.

Chairman
Sindh Textbook Board, Jamshoro

About the Book

The new textbook of Computer Science is for Grade 9 holds some important features. This book is aligned with the Curriculum of Computer Science (2018) reviewed by Directorate of Curriculum, Assessment and Research Sindh Jamshoro. To provide better experience of teaching and learning there are some important things which are included in this book.

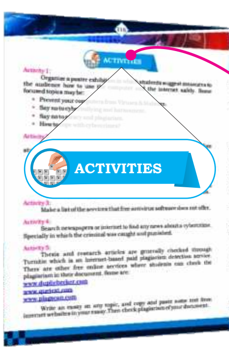


A Textbook is a means to achieve the standards and benchmark that are set in curriculum. The standards and benchmarks are described in curriculum through Students Learning Outcomes (SLOs). SLOs are measureable instructional goals established for a specific group of students over a set period of time. The formative and summative assessments should be based on SLOs. Since in many institutions teachers and students do not have access to curriculum, therefore SLOs are given in each unit.

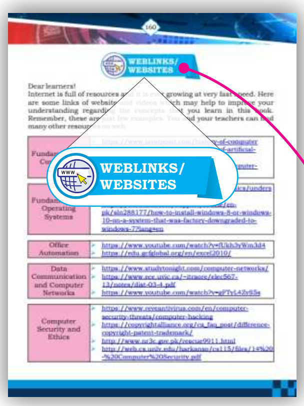
Teacher Note: Teachers are given some guidelines in this textbook wherever needed. This guideline will express how teachers are expected to teach a specific concept.



The exercises in this book discourage rote learning. Many questions are inquiry based. Teachers are expected to facilitate students to find the answers and accept and appreciate the variety of answers as far as they address the questions.



At the end of each chapter, activities are given in this textbook. The purpose of these activities is to inculcate skills and attitude in students to propel self-learning. These activities will challenge students to learn unconventionally.



In our context, students often cannot buy additional reference books. However, in this era of technology, students and teachers can access internet at very low cost. Therefore, the readers can find weblinks at the end of this book for further reading and understanding of any concept given in this book.

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

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SLOs

- Demonstrate the understanding about the history of computers
- Outline the various generations of computers
- Classify the computers as per their size and technology used to date

1.1 INTRODUCTION TO COMPUTER

A computer is an electronic data processing machine or device that performs processes, calculations and operations based on instructions provided by a program. Computers are now used vastly in every field of life. The advancement in computer caused advancement in knowledge, science and technology. Today, computers are used in fields of business, industry, education, banking, transportation, research, explorations, media, entertainment,etc.

1.1.1 Evolution Of Computers

The computers which we see today are modern shape of computers which have been evolved since centuries. The evolution of computers is generally divided in following three eras.

(i) Mechanical Era (Dark Age)

Men have been trying to invent machines that can solve mathematical problems. In mechanical era, human became successful to make simple machines that could help performing simple arithmetic operation, in other words computing. These machines were manually operated since the electricity was not invented. Some of the important machines of this era are:

(a) Abacus (3000 B.C.)

Abacus was invented about 5000 years ago. It is also known as counting frame. Abacus is still used to teach basic arithmetic operations to the students. Abacus is considered as first computer prototype.

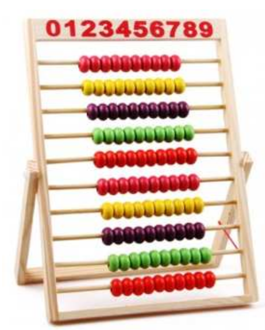


Fig: 1.1 Abacus

(b) Napier's Bones (1612 A.D.)

Scottish mathematician John Napier developed Napier's Bones, in 1612.It is also called Napier's Rods. It was a small machine that contained ten rods. The rods were made up of bones, wood or metal. Napier's Bones was used for multiplication and division.



Fig: 1.2 Napier's Bones

(c) Slide Rule (1622 A.D.)

English mathematician William Oughtred invented a Slide Rule. This was basically a pair of two moveable rules placed side by side. They had a standardized set of markings called scales. These scales were used for mathematical computations. Slide Rule was used to multiply and divide numbers. The modern slide rules are still used in some countries.

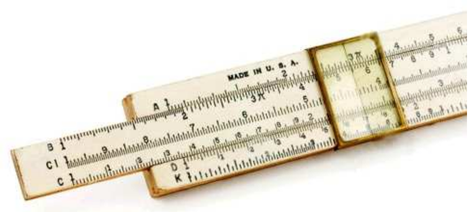


Fig: 1.3 Slide Rule

(d) Pascaline or Pascal's Calculator (1642 A.D.)

French mathematician Blaise Pascal invented a mechanical calculator which was called Pascaline. He developed this machine to help his father who was a tax collector. Pascaline can perform addition and subtraction by eight figures. User had to adjust wheels in order to perform these calculations.



Fig: 1.4 Pascaline

(e) Leibniz's Calculator (1694 A.D.)

Leibniz's Calculator was developed by the German mathematician Gottfried Wilhelm Leibniz. It was also called stepped reckoner. It was the first calculator that could perform all four basic arithmetic operations; addition, subtraction, multiplication and division.

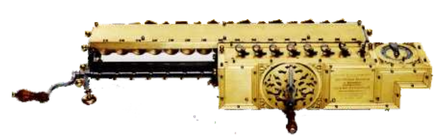


Fig: 1.5 Leibniz Calculator

(f) Babbage's Difference and Analytical Engines (1822 and 1837 A.D.)

Charles Babbage was an English mathematician and mechanical engineer. He is known as Father of Computer because he developed the first complete computing machine. His first invention was Difference Engine. It was an automatic mechanical calculator. Difference Engine was a large machine, made of metal and was powered by steam. The Difference Engine had storage (mechanical memory) that could hold the data temporarily for processing and to store results. It was used to allow a user to enter calculations and get printed results. The Difference Engine worked on difference equations.

Then, Charles Babbage designed but could not build a very big machine in 1837. This was named Analytical Engine. The proposed design included an ALU with basic programmatic flow control. It was programmed using punched cards and contained integrated memory. Historians consider it to be the first design concept of a general-purpose computer because of its comprehensive design.

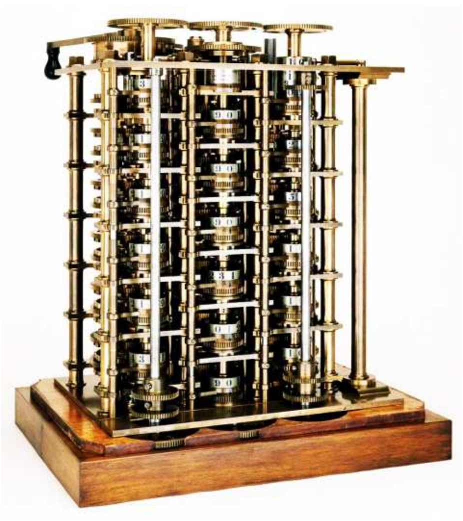


Fig: 1.6 Babbage's Difference Engine

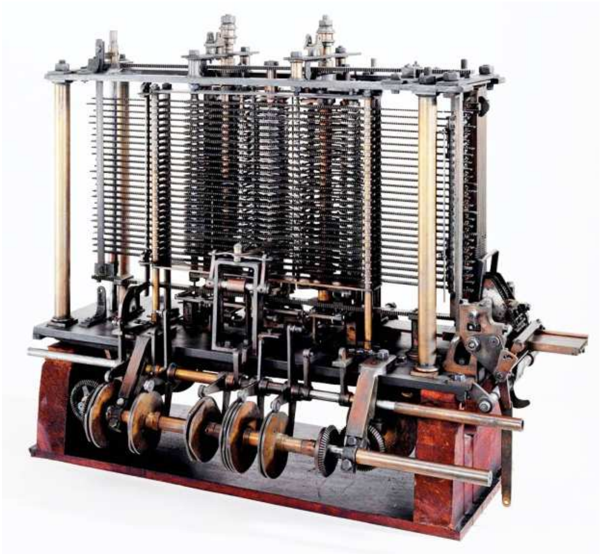


Fig: 1.7 Babbage's Analytical Engine

(ii) Electro-Mechanical Era (Middle Age)

This era starts from the mid of 19^{th} century. In this era scientists became able to develop faster and more accurate computing machines as they were powered by steam and electricity. One of such machines was Tabulating Machine.

(a) Herman Hollerith's Tabulating Machine (1890 A.D.)

It was invented by American inventor Herman Hollerith in 1890.Hollerith's first tabulator was used for the U.S. 1890 Census. Because of Hollerith's tabulating machine census data took only six months to compile, which was very fast as compared to previous U.S. census in 1880 which took 7 years to be completed. Hollerith Tabulating Machine became very famous and used in many offices of U.S. Government.



Fig: 1.8 Tabulating Machine

(iii) Electronic Era (Modern Age)

The advancement in the vacuum or electron tube gave birth to the electronic era. In this era the true computers were invented which worked on the principle of input, store, process and output. Continuous advancement in electronic engineering increased efficiency and speed of computers considerably. The electronic era may be categorized in generations on the basis of core technology used to build computers.

(a) First Generation of Computers (1940 to1956)

Based on vacuum tubes, first generation computers were very large in size. This generation computers used machine language (i.e. 1's and 0's).Magnetic drums were used as primary internal storage medium and punched cards for input. In this generation mainly batch processing operating system was used. Computers of this generation were primarily used for scientific and research purposes. Electronic Numerical Integrator and Calculator (ENIAC), Universal Automatic Computer (UNIVAC) are examples of first generation computers.



Fig: 1.9 Vacuum Tubes

(b) Second Generation of Computers (1956 to 1963)

Because of transistors computers became smaller, faster, cheaper and more efficient. Assembly language and a high-level language FORTRAN were introduced. Magnetic core was used as primary internal storage medium. Punched Cards were used for input. Batch processing and Multiprogramming Operating systems were used. These computers were mainly used for commercial productions, scientific and engineering analysis and design. Examples are IBM 7094 and IBM 1401.



Fig: 1.10 Transistors

(c) Third Generation of Computers (1964 to 1971)

Use of ICs further decreased size of computers and increased the speed and efficiency. Less expensive computers were introduced. High level programming languages such as Pascal and COBOL were used. Keyboard as input and monitor as output also eased the use of computer. Time-sharing and Realtime Operating Systems were used. The use of computers was extended to database management and automatic industrial control. IBM 360 and IBM 370 are the examples of this generation's computers.



Fig: 1.11 Integrated Circuits (ICs)

(d) Fourth Generation of Computers (1971 to Present)

The invention of microprocessors was revolutionary which caused the development of faster, less expensive, smaller and more reliable computers. They used semi-conductor memories RAM and ROM and magnetic storage became popular. More high-level languages were introduced like C, C++, Java, etc. These computers are used in almost every field of life, like space applications, business and art work.

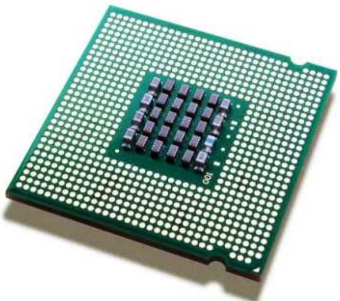


Fig: 1.12 Microprocessors

Time sharing, real time and distributed operating system are used. This generation also saw the development of Graphical User Interfaces (GUIs). Examples are Apple Macintosh, IBM PC.

(e) Fifth Generation of Computers (Present and Beyond)

Fifth Generation computing devices are still being developed. In this generation computers will be capable of self- learning, reasoning and generalization. These computers or controlled machines like robot will also be able to process human languages. The branches of AI include; Machine Learning, Deep Learning. Natural Language Processing, Robotics and Expert Systems.

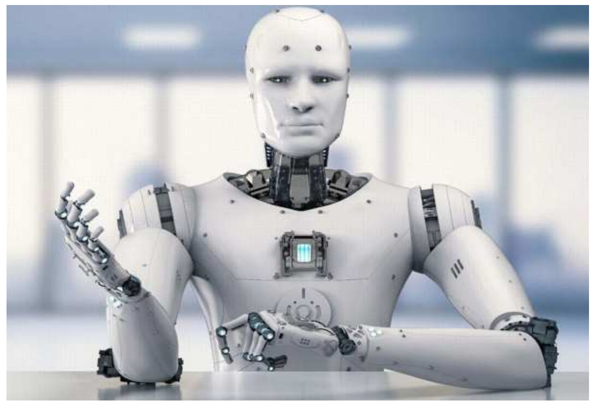
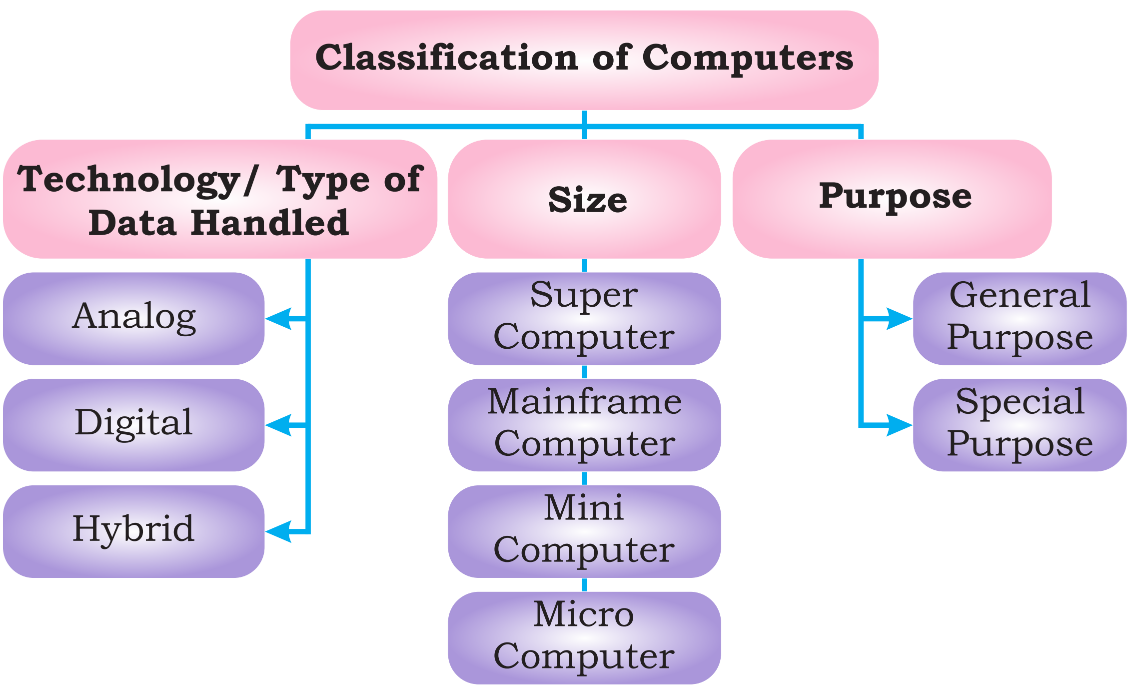


Fig: 1.13 Humanoid Robot

1.1.2 Classification Of Computers

Computers can be classified into different ways as shown below:



(i) According to Technology

According to technology or type of data they handle, computers are classified into three types.

(a) Analog Computers

Analog Computers are used to process analog data. Analog data are in the form of continuously varying physical quantities like pressure, temperature, voltage, speed and weight. Examples of Analog computer are speedometer of a car, voltmeter etc.



Fig: 1.14 Analog Computer

(b) Digital Computers

Digital Computers are most commonly used type of computers. They are used to process information with quantities using the binary number system (0's and 1's). Digital Computers are used in home, educational institutes, offices, business, scientific fields, etc.



Fig: 1.15 Digital Computer

(c) Hybrid Computers

Hybrid Computers are the combination of Analog and Digital Computer system. These computers combine analog and digital features of computers in a single machine. A Hybrid Computer uses analog to digital and digital to analog conversion. It may input or output either digital or analog data.



Fig: 1.16 VA Meter

(ii) According to Size

Computers are also divided into four groups according to their size.

(a) Super Computers

Super Computers are the most powerful, fastest and largest computers. They are extremely expensive. These computers are widely

used in scientific applications such as aerodynamics, design simulations, processing of geological data, weather forecasting and nuclear research.

(b) Mainframe

Mainframe Computers are powerful multi-user and multi-processors computers. They can process huge amount of calculations at very high speed. Mainframes are also very expensive and require a lot of technical expertise to be installed and operated. They are used in banks and many large business organizations where several users work simultaneously.

(c) Minicomputer

These are smaller than mainframe computers, but they are more powerful than Microcomputers. Minicomputers usually use multi-user operating system. Multiple users can use the Minicomputers through terminals. Minicomputers may be used as network servers and Internet servers. DEC VAX and IBM AS/400 are good examples of minicomputers.

(d) Microcomputers

Microcomputers are also called Personal Computers (PCs). The use of microprocessor has made computers cheaper yet faster and more reliable. These are the smallest computers designed to be used by individuals. PCs can be used for variety of tasks like documentation, calculations, illustration and entertainment. The power of network and internet has also made it more useful. Now computers are also used for communication and socialization.

(iii) According to Purpose

According to purpose, computers are either general purpose or special purpose.

(a) General Purpose Computers

Most computers in use today are General Purpose Computers. These computers can process variety of tasks. These computers can store and execute different programs in their memory. Therefore, various tasks like word processing (typing & editing), payrolls, accounts, inventory

control, manipulating facts in a database, making scientific calculations and statistical data analysis, and controlling security system of an organizations are achieved by these computers. Desktops, laptops, tablets and smart phones are examples of General Purpose Computers.



Fig: 1.17 General Purpose Computer

(b) Special Purpose Computers

As the name states, Special Purpose Computers are designed to perform specific tasks. Special Purpose Computers repeatedly perform single job more efficiently. They are also known as Dedicated Computers. These computers are useful in traffic lights control system, navigational system, aviation, weather forecasting, satellite tracking and ATMs.



Fig: 1.18 Computerized Wheel Alignment Machine

SLOs

- Explain the uses of computers in different fields of life.
- Discuss how computer is affecting our lifestyle by providing variety of choices for entertainment and day to day tasks.
- Tell about scope of the different careers in IT sector.

1.2 ROLE OF COMPUTER

The role of computer in our lives is increasing day by day. In this section, we will discuss different aspects of the changing role of computer.

1.2.1 Computers In Different Fields Of Life

We are living today in the information era and the information has become one of the most valuable assets. To process this information, we make use of computers in various fields in our daily life. Computers have been integrated in our life in different shapes and sizes like desktops, laptops, mobile phones, gaming consoles and smart devices. Our lives have become so dependent of computers that we cannot work even a single day without the help of it. We have automated many of the repetitive tasks with the help of more advanced, faster and accurate computers and

brought our routine tasks, office works, businesses, researches and industrial applications to a new level.



Fig: 1.19 Radiology computer

Computers are largely used in every field of life. Manufacturing, ecommerce, education, medical, banking, communication, entertainment, engineering, agriculture, architecture, business, defense, and sports are highly influenced by computers.

Computers Today and Tomorrow

21st century is the era of technological revolution. Previously, technology was only used to access and share information. However, with the passage of time, the rapid change in technology has made it nearly impossible to perform any human activity without its use.

Computers are playing an important part in our daily life. News, weather updates, travelling information and bookings, money transfer and even taxi bookings are done with the help of mobile phone apps. Many managerial tasks are also done by computer software. School, library and hospital management are some examples. Online shopping is becoming a trend in our society too.

Computers are also providing variety of choices for entertainment like online games in which players from different parts of the world can participate simultaneously. 3D graphical software has given a new look to movies in which different comic characters can act with human actors. Photo, sound and video editor software not only help artists and singers to produce extraordinary creations but also inexperienced people can enjoy their productivity with ease of use.

The emerging technologies are also getting better day by day and we can imagine that how computer will be used in future. Artificial Intelligence, Robotics, Wireless Communication and Virtual Realities are some areas which are shaping the modern world.

Artificial Intelligence is based on simulating human intelligence in machines that can easily mimic and execute tasks from simple to more complex operations. The term A.I. may also be referred to any machine that displays qualities associated with a human brain such as learning, reasoning and problem solving. A.I. is also used for Machine Learning. It learns from our daily routines and suggests us different options. Like google maps suggest the best ways for our daily commute. A.I. is vastly used in scientific experiment, healthcare and space technologies.

Robots are the machines that can be controlled by a computer and are capable of carrying out a complex series of actions automatically. Robots can be controlled by an external control device or through programming. Robotics deals with designing, creating and programming of the robot and enhancing it by taking sensory feedback and processing information. Robots are commonly used in manufacturing, industry, science, medicine and education.

Wireless Communication has become an integral part of our lives. Wireless communication technology transmits information using electromagnetic waves like IR (Infrared), RF (Radio Frequency), satellite, etc. Global Positioning System (GPS) is now used to find real time location of people and objects. Smart phones that include 3G, 4G and 5G networks have transformed the conventional use of telephones. These phones not only provide better coverage but also fast mobile internet experience. Wireless communication is also giving new meaning to the socialization and human interactivity.

Virtual Reality is an artificial environment that is created with software and presented to the user in a way that the user feels it as a real environment. Virtual reality can be used for the simulation of a real environment for training and education. It is also used for development of an imagined environment for a game or interactive story.

Teacher Note

It is very important to orient students about the contemporary and upcoming technologies. Teachers may show videos on smartphone or projectors for better understanding of students, in this regard.

1.2.2 Careers In IT Field

Today Computer Science plays a key role in all fields of life. Computer Science (CS) jobs are ranked as having some of the highest salaries in the world. It's no surprise that Computer Science and Information Technology (IT) are changing tomorrow's job market. Let's look at different careers that are present in the IT sector.

(i) Software Engineer

A Software Engineer is a person who uses different programming languages to develop software products like games, Learning Management System (LMS), business applications, educational and entertainment software.

(ii) Network Administrator

Network Administrator is an IT expert who manages an organization's network. He or She is responsible for installing, maintaining and upgrading any software or hardware required to efficiently run a computer network.

(iii) Database Administrator

A Database Administrator (also known as DBA) is a skilled professional who maintains a secure database environment in an office, business or organization.

(iv) Web Designer

Web is short for World Wide Web or www. This is another name for internet. Web designers are people who build websites. They prepare a site's content with eye-catching designs, attractive images and strong text. They rely on many web designing tools to ensure an interactive website. How the site works and how it looks is the responsibility of web designers. They are also responsible for maintaining and updating an existing site.

(v) Graphic Designer

Graphic is another word for image. Graphics Designers develop overall layouts of brochures, magazines and other types of published

advertisements and documents. They do this by using various computer graphics software. This task is usually accomplished by combining art and technology, conveying ideas through images, layout of websites and printed matter.

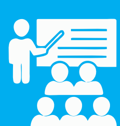
(vi) Information Security Analyst

These people protect networks. They plan and carry out security measures to ensure that no loss of data (or information) occurs. We can call them the police force of the internet. Computer technology has expanded into online banking and businesses. Computer hackers are always on the lookout for customer account details that they can use to steal money. Information Security Analysts ensure that no such theft occurs.

(vii) Computer Science or IT Teacher

Another very rewarding career for Computer Science graduates and post-graduates is teaching in schools, colleges and universities. These instructors instill in their students the importance of computers in today's world, and the impact these machines will have in their later lives.

SLOs



- Describe computer hardware
- Explain the function of different parts of system unit like: Motherboard, Processor
- Differentiate between various input devices
- Recognize different output devices
- Differentiate between Primary and Secondary memory
- Classify different hardware devices as per their functionality

1.3 COMPUTER HARDWARE

Computers consist of software and hardware. Software is the programs and applications that run on computer. Hardware is the physical parts of the computer that run programs and applications. Hardware can be seen and touched while software cannot.
Computer hardware is a collection of all the physical parts or components of a computer. It includes the computer casing, the CPU or Central Processing Unit, computer memory, VGA graphics card, sound card, and the motherboard.

1.3.1 System Unit

A System Unit is the part of a computer that contains the primary devices. The system unit performs operations and produces results for complex calculations. It includes the motherboard, CPU, RAM and other components, as well as the case in which these devices are enclosed.

(i) Motherboard

The motherboard is the main board which connects different parts of computer. It includes the following general components: Microprocessor (CPU), Slots, Ports, Buses, RAM, ROM and other electronic components for example resistors, capacitors, diodes, transistors, jumpers etc.



Fig: 1.20 Motherboard

Just like nervous system it allows communication between all parts of the computer. We can find CPU, memory slots, expansion slots and a number of chipsets on motherboard. Motherboards are made of layered fiberglass. These layers contain copper lines that form the circuitry by which electrical signals are provided to all parts of computer. Various components of computer may be attached, detached and upgraded on motherboard according to need of the user. Motherboards also have connectors called ports. These ports are used to connect input, output and other peripheral devices.

Teacher Note

Uncover the casing of computer and demonstrate different parts on and attached with motherboard. Ask students to write names and functions of the components.

(ii) Microprocessor (CPU)



Fig: 1.21 Microprocessor

CPU or microprocessor is the brain of computer. The microprocessor is a chip containing millions of tiny transistors. These transistors manipulate data. Microprocessor performs all the calculations necessary to make the computer work. These calculations are performed at very high speed and accuracy. Microprocessor is made up of silicon. The microprocessor fetches, decodes, executes and stores all the instructions given by the user or any other device. The speed of computer mainly depends upon the speed of microprocessor. A microprocessor that has faster clock speed (measured in GHz) and more cores and cache works faster.

There are typically five components of a microprocessor.

(a) Arithmetic Logic Unit (ALU)

ALU performs all the actual calculations like arithmetic operations and logical comparisons. Arithmetic operations include addition, subtraction, multiplication and division while logical comparisons include comparing, selecting and matching of data.

(b) Control Unit (CU)

Control Unit is responsible for controlling the transfer of data and instructions among other units of a computer. This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations. CU functions just like a traffic policeman. It manages and coordinates all the units of the computer.

(c) Clock

Clock generates pulses and instructions are executed on the basis of pulses. Clock speed is measure in MHz and GHz.

(d) Registers

It is a temporary storage area that holds the data that is being processed. It is also known as programming model which may be of 8 bits, 16 bits, 32 bits or 64 bits.

(e) Cache

Cache is an intermediate storage area, which is available inside microprocessor. The immediate processed information is stored in cache. The cache inside the microprocessor is called internal cache and outside is called external cache.

(iii) Buses

In computer, Buses are the electric paths on which data is sent and received by different components. They are just like roads. As roads connect different places, buses connect all the parts of the computer to each other. They also connect all internal components on the motherboard.

There are three types of buses; control bus, data bus and address bus.

Control Bus carries command between different components to control all activities in a computer.

Data Bus carries data between the processor, memory unit and other components.

Address Bus carries the address of the data (but not the data).The address bus is used to specify memory location to be used by microprocess for specific operaation.

1.3.2 Input Devices

Input devices are used to enter data into computers. These devices can be categorized into Text Entering, Pointing and Image Scanning Devices.

(i) Text Entering Devices

Keyboard: It is the most common text entering device and used to enter data usually in text format or to perform other controlling functions.

When a key is pressed, keyboard controller chip sends its corresponding code in keyboard buffer called scan code, which is then processed by CPU.

(ii) Pointing Devices (Mouse and its variants)

They are used for the quick movement of cursor on screen needed usually in graphic mode. It includes mouse, joy stick, track ball and track pad.

(iii) Image Scanners

Scanners convert image into electronic format understandable by computers through light sensing. They also work on Optical Recognition which occurs when a device scans a clear printed surface and translates the image into machine-readable formats that a computer understands. Image scanners include Optical Mark Recognition (OMR), Optical Barcode Reader (OBR) and Optical Character Recognition (OCR).

(iv) Other Types of Input devices

There are also other input devices. For example, microphones are used to accept sound input and convert it in digital audio format. Microphones are also used for voice recognition which can convert voice input into text files. Touch Screen is also used for input. It accepts input directly on monitor by touching finger or any object on the screen. Magnetic Ink Character Recognition (MICR) and Magnetic Strip Reader are also used for input.

1.3.3 Output Devices

A hardware device that sends data from a computer (CPU) to another device or user is called an output device. The most common output devices of a computer are monitor and printer. There are two types of output devices.

(i) Soft Copy Output Devices

It is screen display or voice output. It is volatile output and lost when other output is shown or computer is turned off. Following are some of the devices used to give output in soft form.

(a) Monitors

It is TV like device that displays data by small bright dots called pixels. Monitors are of two types.

- Cathode Ray Tube (CRT)
- Flat Panel Display (FDP)

(b) Data Projectors

Data projectors are used to show colorful slides and images directly from computer disk on a wall or large screen through an optical lens. They are also called digital light projectors and video projectors.

(c) Speakers

Speakers give output in form of sound. They are good for people with visual disabilities or where display is not easy.

(ii) Hard Copy Output Devices

It is output on paper. It is nonvolatile output that is relatively stable and permanent form. Hard Copy Output Devices are:

(a) Printers

They usually give output on paper and can print both text and graphics. There are two types of printers:

- Impact
- Non-Impact

(b) Plotters

Like printer it gives images on paper but typically used to print large format images such as maps, construction drawing, advertising hoardings etc.

1.3.4 Storage Devices

A storage device refers to a hardware used to store information. There are two types of storage devices; Primary and Secondary.

(i) Primary Storage Devices

Primary storage devices are used by computer during processing. They are quite smaller in storage capacity. Most primary storage devices are found inside the computer, and they have the fastest access to data. Primary devices include RAM and ROM.

ROM is the Read Only Memory. It is permanent memory. ROM is quite small in capacity. It stores the major setting of computer permanently.

RAM is Random Access Memory. RAM is volatile, means it loses its content as the power supply is disconnected. This is used to store data and instructions temporarily.

(ii) Secondary Storage Devices

Secondary storage devices have a larger storage capacity and can store data permanently. Users save their data on secondary storage devices. Hard Disk, CD and DVD, SD Card and USB flash disk are the examples of secondary storage devices.

SLOs

- Understand the basic operations of computer
- Differentiate among the four basic operations of computer
- Draw the block diagram of computer's basic operations

1.4 BASIC OPERATIONS OF A COMPUTER

A computer is a machine that acts according to the instructions given by the user. A computer performs four basic operations: input, processing, output and storage.

(i) Input

Computer input has many forms. It can be from a command entered using a keyboard or a mouse. It can be data sent from another computer on a network.

(ii) Processing

Processing is done inside the computer by CPU. Processing is the conversion of input into output. After processing, data is turned into meaningful information. This is carried out with the help of arithmetic and logical operations.

(iii) Storage

Storage refers to the holding or saving data. RAM, ROM and Hard Disk are the devices that are used for storage.

(iv) Output

Output is the result of a computer processing. Output may be viewed on a monitor screen, heard through speakers or printed on paper. Here, monitor screen, speakers and printer are called output devices.

SLOs

- Develop the understanding about computer software
- Recognize various types of system software
- List out the names of different application software
- Differentiate between application software and system software

1.5 COMPUTER SOFTWARE

Software is a set of instructions that a computer uses to perform a task. It is a general term for a computer program. There are two main types of software; System Software and Application Software.

1.5.1 System Software

System software is a computer program that coordinates all activities and functions of a computer. It also controls all the operations of the computer hardware. It includes operating systems, device drivers, utility programs and language translators.

(i) Operating System

Operating system is the master control program that manages all the system resources. It creates an interface between computer system and user. Windows and Linux are commonly used operating systems.

(ii) Device Drivers

Device drivers are computer programs that control a particular device when it is connected to a computer. Any hardware that we have in our computer must have a device driver to communicate with operating

system. A device driver is a translator between the operating system and the hardware device. For many devices, operating system has drivers pre-installed in them. This gave rise to the concept of Plug and Play, where the device would be attached to the computer and the operating system will instantly recognize it. A non-plug-and-play device would require you to go through several steps of installing drivers and setting up the device before it would work.

(iii) Utility Programs

Utility means being useful. Utility programs are useful computer programs that help to manage, maintain and control computer resources. Operating systems usually have pre-installed programs that can serve the purpose, but utility software provides further functionality. One example of utility program is an antivirus software. This computer program helps to protect a computer from viruses and other harmful files.

Hard Disk tools are also part of utility programs. They manage hard disk drives and other storage devices. This includes utilities to scan the hard disks for any potential problems. Disk cleaner utility is used to remove any unnecessary files while disk defragmenter is used to re-organize file on a hard disk drive to increase performance of disk.

(iv) Language Translators

Language Translators are used to translate human readable instructions into machine language. Computer can only understand machine language which is composed of 0's and 1's. The computer languages are used to make computer programs (software). Generally, software is written in high-level languages, using natural language words. Language translator are of three types; assembler, compiler and interpreter.

Teacher Note

Teachers are suggested to demonstrate how to configure/ install device drivers and use utility programs like Disk Defragmenter, Disk Cleaner etc.

(a) Assembler: The assembler translates the program written in assembly language into machine language instructions for execution.

(b) Compiler: It translates the entire high-level language program at once into machine language before it is executed.

(c) Interpreter: It translates the high-level language program line by line into machine language.

1.5.2 Application Software

Application Software is used to complete specific tasks, such as creating documents, databases, spreadsheets and presentations. Computer games, media players and web browsers are also the examples of application software. User needs to install application software to accomplish specific tasks. Application software are not pre-installed on operating system. They are installed separately. For example, making spreadsheet is not possible with Windows. For that application software such as MS Excel is used. There are different types of application software.

(i) Productivity Software

This kind of application software is used to produce things such as documents, spreadsheets, databases and presentations. Many of the productivity software are intended to be used in businesses and offices. MS Office for Windows is an example of productivity software.

(ii) Business Software

Business Software are used to manage business activities efficiently. It is used to provide many business functions such as billing, database management and inventory management.

(iii) Entertainment Software

This type of software provides amusement and fulfills a user's hobby. The most common entertainment software are video games.

(iv) Educational Software

Educational software is used for teaching and learning. This kind of software is used in many schools to enhance knowledge of students in learning different subjects.

SUMMARY

- A computer is an electronic data processing machine or device that performs processing, calculations and operations based on instructions provided by a software or program.
- The evolution of computers is generally divided in three eras like Mechanical era, Electro-mechanical era, Electronic era.
- First Generation of Computers (1940 to1956): Technology Used: Vacuum Tubes.
- Second Generation of Computers (1956 to 1963): Technology Used: Transistors.
- Third Generation of Computers (1964 to 1971): Technology Used: Integrated Circuits (ICs).
- Fourth Generation of Computers (1971 to Present): Technology Used: Microprocessors.
- Fifth Generation of Computers (Present and Beyond): Technology Used: Artificial Intelligence Technology.
- Computers are classified in three types according to technology like Analog Computers, Digital Computers and Hybrid Computers.
- Digital Computers are further divided into four groups according to their size like Super Computers, Mainframe Computers, Minicomputers and Microcomputers.
- According to purpose; computers are either General Purpose or Specific Purpose.
- Different careers are present in the IT sector like Software Engineer, Network Administrator, Database Administrator, Web Designer, Graphic Designer, Information Security Analyst, Computer Science or IT Teacher.
- Computers consist of software and hardware.
- Software is set of instructions or a program.
- Computer hardware is a collection of all the physical parts or components of a computer.
- A system unit includes the motherboard, CPU, RAM and other components, as well as the case in which these devices are housed.

- The motherboard is the main board which connects different parts of computer. It includes the following general components: Microprocessor (CPU), Slots, Ports, Buses, RAM, ROM, other electronic components for example resisters, capacitors, diodes, transistors, jumpers, etc.
- There are typically five components of a microprocessor (CPU); Arithmetic Logic Unit (ALU), Control Unit (CU), Clock, Registers and Cache.
- Clock generates pulses and instructions are executed on the bases of pulses. Clock speed is measured in MHz and GHz.
- Register is a temporary storage area known as programming model of 8 bits, 16 bits, 32 bits and 64 bits. Registers are visible as well as invisible on the microprocessor.
- Cache is an intermediate storage area, which is available inside microprocessor IC known as internal cache and outside microprocessor IC known as external cache.
- CPU has three buses; control bus, data bus and address bus.
- The most common input devices of a computer are keyboard and mouse.
- The most common output devices of a computer are monitor and printer.
- There are two types of storage devices; Primary and Secondary.
- Primary storage devices include RAM and ROM
- A secondary storage device like hard disk has a larger storage capacity and can store data permanently.
- A computer performs four basic operations: input, processing, output and storage.
- System software includes operating systems, device drivers, utility programs and language translators.
- Language translators are of three types; assembler, compiler and interpreter.
- Different types of application software are Productivity Software, Business Software, Entertainment Software, and Educational Software.

EXERCISE

A. Choose the right answer:

1. The device that converts hard copy into soft copy is:
   a) printer b) plotter
   c) scanner d) barcode reader

2. The volatile memory
   a) is permanent
   b) loses contents as the power is disconnected
   c) possesses large storage
   d) manages hardware resources

3. Media players are:
   a) business software b) education software
   c) entertainment software d) productivity software

4. The programs that are generally installed to manage and maintain overall computer resources is:
   a) operating system b) utility program
   c) language translator d) device driver

5. Modern languages use
   a) compiler b) interpreter
   c) convertor d) assembler

6. A collection of wires connecting the CPU with main memory that is used to identify particular locations is:
   a) control bus b) data bus
   c) address bus d) memory bus

7. The inexpensive and most commonly used computers are:
   a) super computer b) mainframe computer
   c) minicomputer d) microcomputer

8. Computer cannot start without:
   a) operating system b) utility program
   c) device drivers d) business software

9. Graphical User Interface (GUI) was developed in:
   a) second generation b) fourth generation
   c) mechanical era d) electro-mechanical era

10. A person who uses different programming languages to develop programs is:
   a) database administrator b) web designer
   c) software engineer d) graphic designer

B. Respond the following:

1. Discuss the use of computer in any two fields of life.
2. Differentiate Compiler and Assembler.
3. Differentiate System and Application software.
4. Describe artificial intelligence with examples.
5. Discuss Impact and Non-Impact Printers with examples.
6. Write the use of these storage devices: Hard Disk, USB Flash Disk, SD Card.
7. Which monitor will you prefer in your school; CRT or FPD? Why?
8. List any five components present on motherboard.
9. Prepare a table of generations.

Generation	Period	Technology	Example of Machines
First			
Second			
Third			
Forth			
Fifth			

10. Give examples of business, education, entertainment and productivity software.

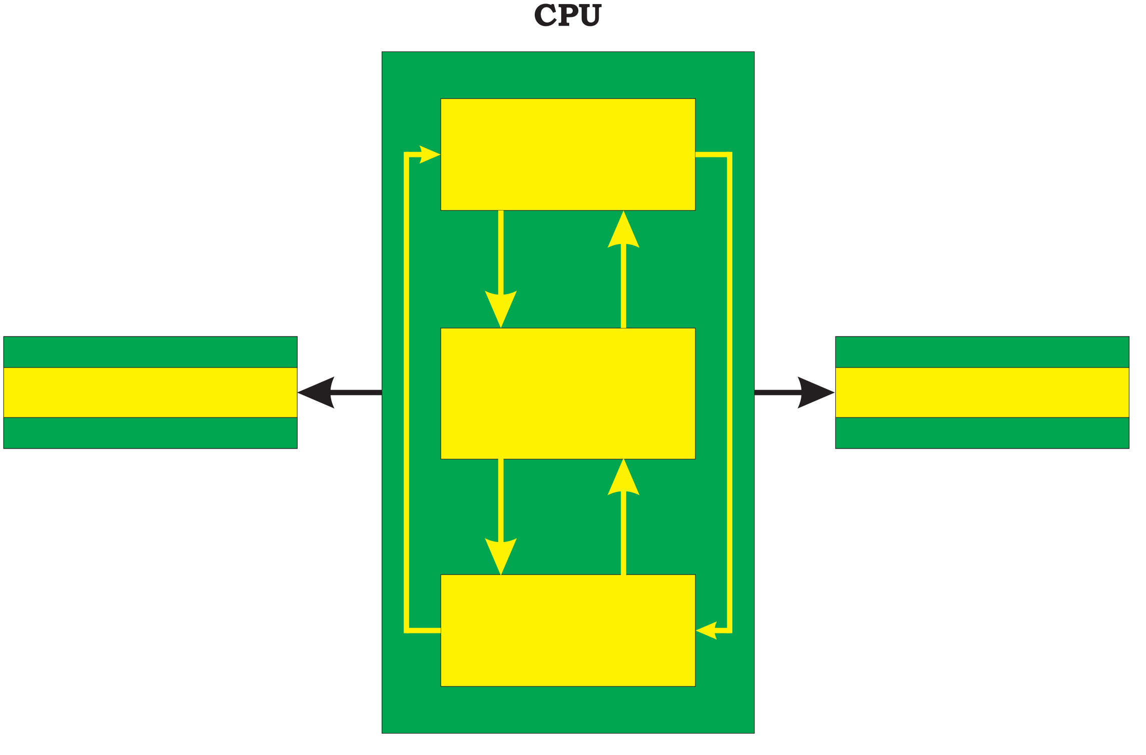
S.No.	Business	Education	Entertainment	Productivity
(i)				
(ii)				
(iii)				

C. Match the columns:

S.NO.	A	S.NO.	B	C
(i)	ALU	(a)	Period of manually operated machines	
(ii)	Input Devices	(b)	PC	
(iii)	Secondary Storage Devices	(c)	Process information using binary number system	
(iv)	Productivity Software	(d)	Perform arithmetic and logical operations	
(v)	Mechanical Era	(e)	Helps to produce spreadsheets, database etc	
(vi)	Digital Computers	(f)	Large storage capacity, store data permanently	
(vii)	Microcomputer	(g)	Hardware device that sends data into a computer	

ACTIVITIES

1. Develop a timeline for major innovations in computer evolution.
2. Prepare a list of input and output devices and write their uses.
3. Make a list of specifications that you should know before buying a computer.
4. List analog, digital and hybrid devices from your surroundings (any five).
5. Label the following block diagram of computer system.



FUNDAMENTALS OF OPERATING SYSTEM

Unit 2



SLOs

- Define OS
- Develop the understanding about different functions of OS
- Distinguish among various types of interfaces of OS

2.1 INTRODUCTION OF OPERATING SYSTEM (OS)

An Operating System is a software which performs all the basic tasks like booting the computer, file management, memory management, process management, and controlling peripheral devices such as hard disk, printer, etc. It manages computer resources efficiently. Most common operating systems are: DOS, Windows, Linux, Android, Mac OS and iOS.

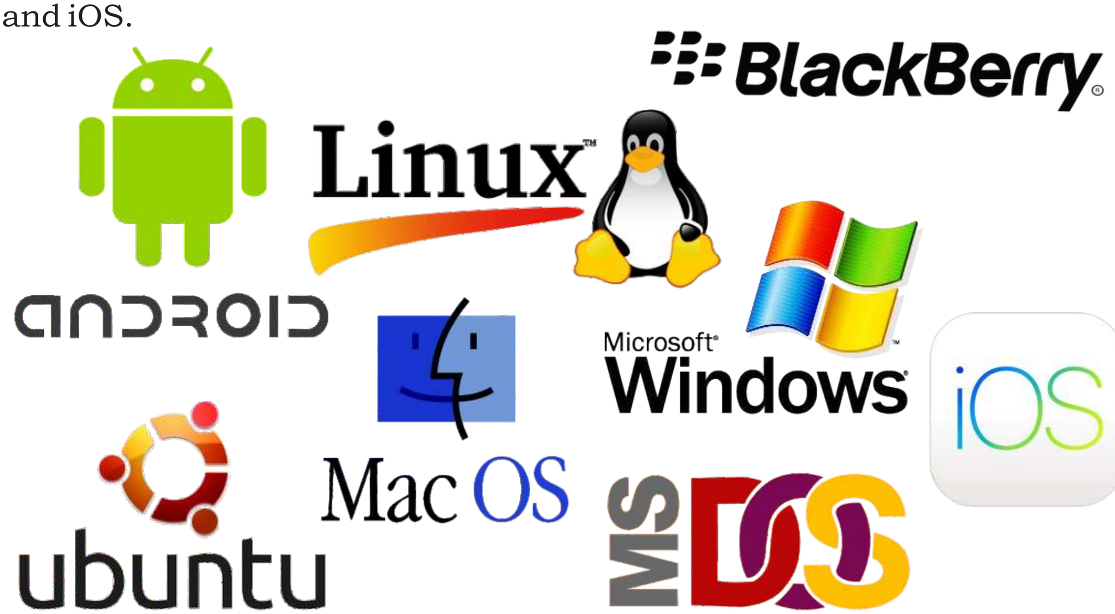


Fig: 2.1 Different Operating Systems

2.1.1 Function Of Operating System

Operating system manages every activity of a computer. It is the master control program that provides an interface for a user to communicate with computer. System software and application software run on operating system as shown in figure 2.2. Operating System performs the following functions.

(i) Booting

Booting is a process of starting the computer operating system. It checks the computer resources and makes it ready to perform different tasks.

(ii) Resource Management

Operating system manages all the hardware and software resources. This includes allocation and de-allocation of processor, memory, access to shared cache memory and access to network resources.

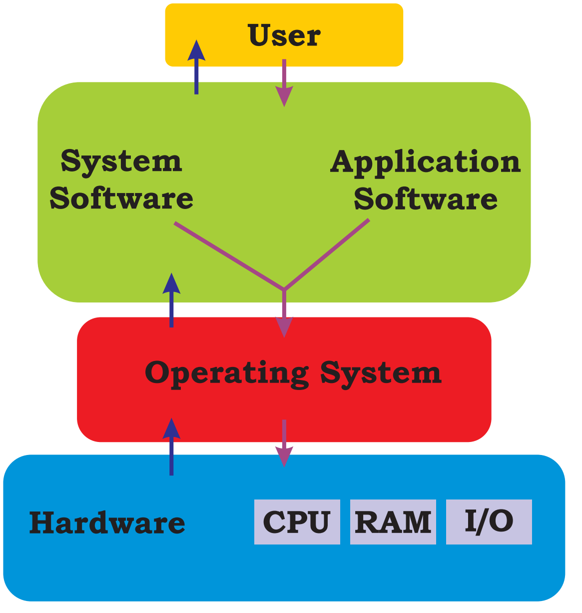


Fig: 2.2 Operations of an OS

(iii) User Interface or Command Interpreter

We interact with operating system through user interface. Command interpreter is one of the parts of operating system which reads the commands from user, interprets them and translates them into machine language instructions that the computer hardware can understand.

(iv) Memory Management

Memory management module performs the task of allocation and de-allocation of memory space to programs and data in need of these resources.

(v) Input / Output (I/O) Management

An Operating System provides the device driver to facilitate I/O functions involving I/O devices. These device drivers are software that control I/O devices through their controllers.

(vi) File Management

It manages all the file-related activities such as organization storage, retrieval, naming, sharing, and protection of files.

(vii) Process Management

A process is a job or activity to be performed by the system. Process management manages creation, deletion, suspension and resumption of processes. The term process refers here to program code that has been loaded into a computer's memory for execution by the central processing unit (CPU). In a multiprogramming system, there will be a number of computing processes. The operating system must ensure that each process gets a fair share of the CPU's time. The OS decides the order in which processes have access to the processor, and how much processing time each process should get. This function of OS is called process scheduling.

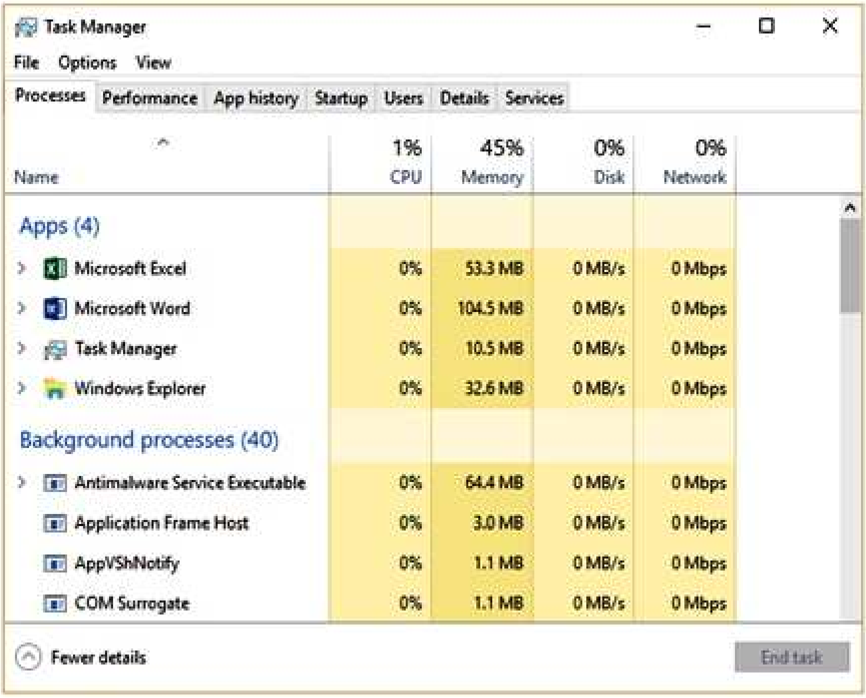


Fig: 2.3 Task Manager

(viii) User Management

In modern operating systems, user management describes the ability of administrators to control user access to various computer resources like software, I/O devices, storage system, networks, etc.

2.1.2 Types Of Interface

An interface is a program that allows a user to interact with the computer or another computer over a network.
A User Interface (UI) is the part of operating system, program, or devices that allows a user to enter and receive information. There are many types of User Interfaces. Two most common user interfaces are discussed below:

(i) Command Line Interface

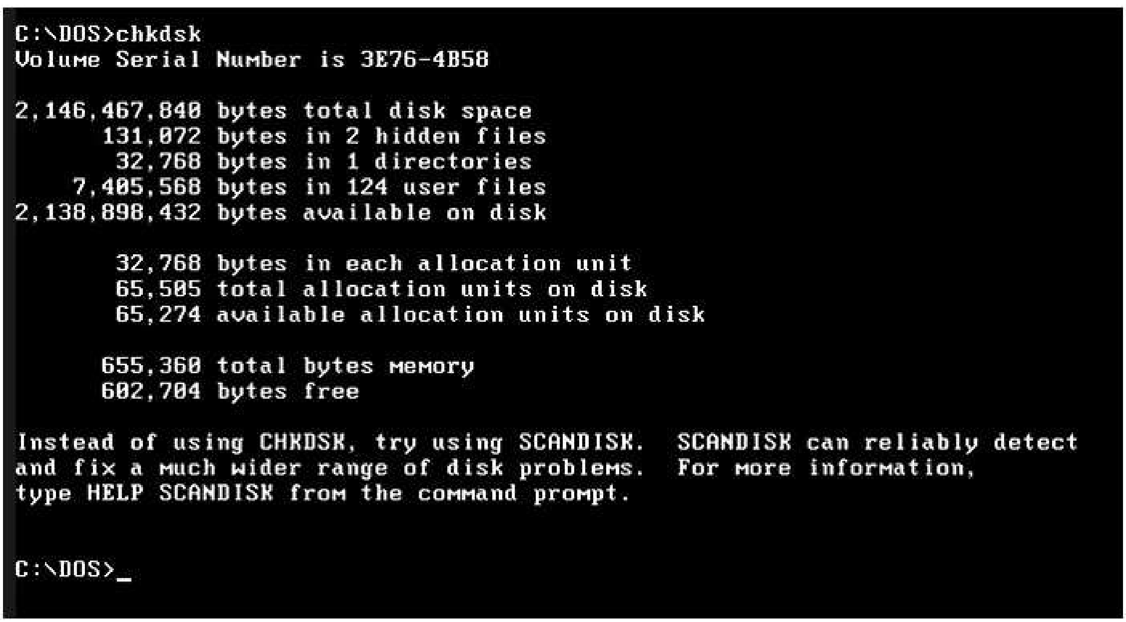


Fig: 2.4 Command Line Interface (CLI)

A Command Line Interface (CLI) is a screen or text based representation in which the user types the commands on place called prompt to operate the computer. Command contains string of characters.CLI is difficult to use because the user has to remember the commands and their syntaxes but it is fast in use because text mode takes less resources.It was primarily provided to users by computer terminals onUNIX, and personal computers including MS-DOS and Apple DOS.

(ii) Graphical User Interface (GUI)

A GUI provides a user friendly environment where user can interact with computers through graphical objects such as menus, icons, buttons and other graphical objects. It is easy to use as users are supposed to just click on a picture to run commands without memorizing them. GUI is slower than CLI as graphical mode takes more memory and resources. Windows and IOS are the example of GUI.



Fig: 2.5 Graphical User Interface (GUI)

SLOs

- Discuss different types of OS
- Differentiate among the various types of OS

2.2 TYPES OF OPERATING SYSTEM

The Operating System can be categorized as under:

- Single User and Multi-User OS
- Batch Processing OS
- Time Sharing OS
- Real Time Processing OS

2.2.1 Single User And Multi-user Operating System

In a Single User Operating System, a single user can access the computer system at a time. These types of operating systems are commonly used. DOS for PCs and Windows 98 for PCs are example of single user operating system.

A Multi-User Operating System allows multiple users to access the computer at same time. The operating system manages the memory and resources among the various users according to the requirement. Linux and UNIX are the most common examples of the multi-user operating system.

2.2.2 Batch Processing Operating System

General term of Batch Processing is used for programs that are executed with minimum human interaction. This type of operating system does not interact with the computer directly (Figure 2.5). Each user prepares his job and submits it to the computer operator. To speed up processing; jobs with similar needs are batched together and run as a group by an operator. The main function of a batch processing system is to automatically keep executing the jobs in a batch.

The benefits of batch processing are:

- Batch systems can be shared by multiple users.
- The idle time for batch system is very less.
- Next job starts just after the current one.

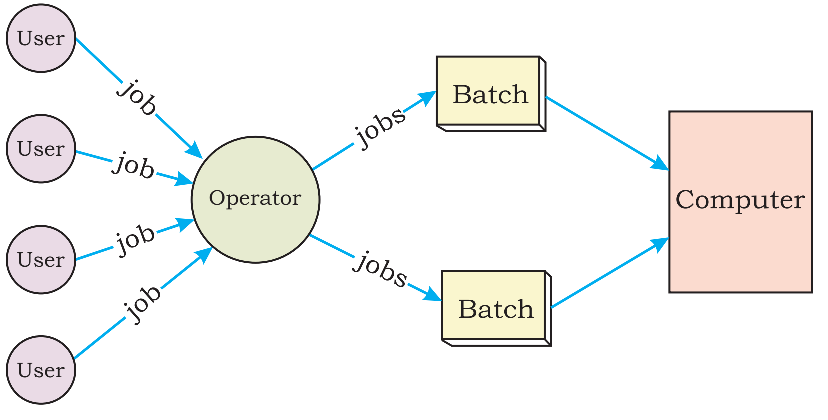


Fig: 2.6 Batch Processing Operating System

2.2.3 Time Sharing Operating System

Time sharing is a method that allows multiple users to share resources simultaneously. Multiple users can use specific computer at the same time in different places. A time sharing operating system is that in which from many tasks each task is given some time to execute so that all processes run smoothly without any problem. Multiple jobs are executed by the CPU by switching between them. As the system switches rapidly from one task or user to the other, a short time slot is given to each task or user for their executions and all feel that system is not shared. Thus, the user can receive an immediate response. For example, in a transaction processing, the processor executes each user program in a short time.These systems are also known as Multitasking Systems. The task can be from single user or from different users also. The time that each task gets to execute is called quantum. After this time interval is over OS switches over to next task.

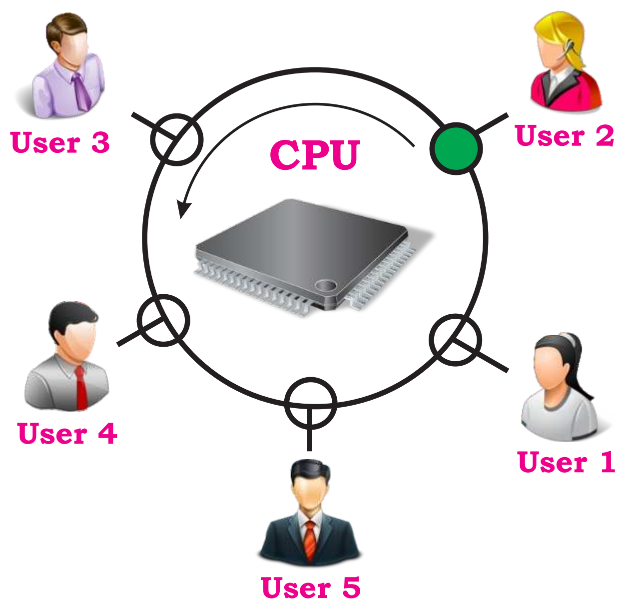


Fig: 2.7 Time Sharing Operating System

2.2.4 Real Time Processing Operating System (RT OS)

A Real Time Processing Operating System is a time bound operating system which has fixed time limit. Processing has to be done within the defined time limit otherwise system will be failed. Real Time Process System classified into two parts:

Hard Real Time System: A Hard Real Time System guarantees that critical tasks complete on time, even the shortest delay or urgency is not acceptable. Here system should meet the deadline. Missile systems and Air Traffic Control System are best examples of Hard Real Time System.

Soft Real Time System: In this time constraint is less strict. The meeting of deadline is not compulsory for each task, every time. A critical real-time task gets priority over other tasks until it completes. It does not guarantee that task will be completed in defined time but before a certain time and according to the priority. Online Transaction System, Airline Ticket Reservation in which reservation could be delayed but should be done after checking available seats and completed before aeroplane flight, etc. are the examples of Soft Real Time System.

SLOs

- Apply and demonstrate the installation process of Windows OS and other software in a computer
- Apply installation process of any antivirus in a computer.

2.3 SOFTWARE INSTALLATION

Software installation is the process of making programs ready for execution. Software installation or installer is a computer program that installs files, such as applications, drivers, or other software, onto a computer. Software is installed onto a computer by various means. They can be downloaded from the internet. They can also be installed from an installation CD or DVD or from a USB flash drive.

2.3.1 Installing Windows Operating System

Operating system is the most essential software and there are many operating systems available. Windows is the most commonly used operating system which is developed by Microsoft. Choosing an operating system depends upon the hardware that we have. To maintain compatibility between hardware and software, the operating system vendor specifies the minimum hardware requirement. For installing Windows 10, we will need at least the following configuration.

Processor	1GHz (speed of CPU should be at least 1 Gigahertz)
Memory	1GB for 32-bit or 2GB for 64-bit (RAM – Random Acces Memory – a type of computer memory, 32 bit and 64 bit are data units)
Storage	32GB (hard disk space should be at least 32 Gigabytes)
Graphics card	DirectX 9 or later with WDDM 1.0 driver (graphics card is computer hardware that produces images seen on monitor screen)
Display	800x600 (computer monitor capability)

Major Steps for Installing Windows

- Insert the Windows Installation DVD/Flash Drive
- Restart your Computer
- Wait for the first startup screen
- Press or hold Del or F2 to enter the BIOS screen
- Locate the Boot order/ Boot sequence
- Select Boot order/ Boot sequence as per your installation source
  - a. USB Flash/USB Hard Disk
  - b. USB CD/DVD ROM
  - c. Internal CD/DVD ROM
- Select any option:
  - a. Upgrade
  - b. Customize Installation (Advance)
- Select any drive for installing your operating system
- Follow the on screen instructions

Teacher Note

- Teachers should focus and reinforce on important steps of installation like selection of drive, formatting and deleting drive and other setting.
- Ideally, students should be given a chance to install Windows in groups.

2.3.2 Installing Office Automation Software

Windows is an Operating System which needs to install other software to make the best use of our computer. Office Automation software is the most common software package that we install on our computers. Office Automation software is a group of computer programs that help users in their daily work. Generally you will find MS Office in school lab, offices and other places. MS Office contains word processor (MS Word), spreadsheet (MS Excel), multimedia presentation (MS PowerPoint), database management system (MS Access) and email application (MS Outlook). In class 9, we will use MS- Word, MS Excel and MS-Access in coming units.



Fig: 2.8 Common Programs in MS Office

To install MS- Office package we need to take following steps.

- Run the MS- Office setup from USB, DVD or Hard Disk backup.
- Check the box marked 'I accept the terms of this agreement' and click on 'Continue'.
- Enter Product Key
- Click on Install Now or Customize procedure.
- Select the package which you want to install. Click on 'Install Now'.
- Then installation begins.
- MS Office installer will notify automatically after finishing the installation.

Before installing MS- Office, make sure that your hardware and software meet with the minimum requirements for the version of MS- Office that you want to install. The minimum requirements may differ from version to version. (For MS- Office 2013 the minimum requirements are: 1.6 GHz processor, 1 GB RAM, 3 GB hard disk free space, minimum Windows 7 operating system and graphics driver).

2.3.3 Installing Antivirus

To keep our computer secure and free from viruses, we need to install an antivirus software. A number of free antivirus software are available online. AVG, Avast, Avira and Kaspersky are some of the free antivirus software. These days we need to download installation file from respective antivirus software and run it but make sure that computer has the access of internet. After running the installation file, antivirus software will be automatically installed on our computer.

Most important component of an antivirus software is the virus database which antivirus software updates time to time. We must update our virus database for preventing virus threats.

Teacher Note

- There are 5 lab periods allocated to complete the SLOs of this unit. However, teachers can manage more practical for students and help enhancing their skills to use operating system efficiently. Students at this level should be able to manage files and folders and configure simple settings of operating system.
- Teachers are also suggested to demonstrate the installation and configuration process of any hardware driver e.g. printer.

SUMMARY

- An Operating System is a software which performs all the basic tasks like booting the computer, file management, memory management, process management, and controlling peripheral devices such as hard disk, printer, etc.
- Operating System performs the following functions like Booting, Resource Management, User Interface or Command Interpreter, Memory Management, Input / Output Management, File Management, Process Management, User Management.
- An interface is a program that allows a user to interact with the computer or another computer over a network like Command Line Interface, Graphical User Interface (GUI).
- The Operating Systems have been evolved as Single User and Multi-User OS, Batch Processing OS, Time Sharing OS, Real Time Processing OS.
- A single user operating system allows only one user to operate computer at a time.
- A Multi-User Operating System allows multiple users to access the computer at same time.
- In fact the real time operating system consists of Windows, Linux, etc.
- In batch processing operating system each user prepares his job and submits it to the computer operator.
- Time sharing is a method that allows multiple users to share resources simultaneously.
- A Real Time Processing operating system is a time bound operating system which has fixed time limit.
- A Hard Real Time System guarantees that critical tasks complete on time. Missile systems and Air Traffic Control System are best examples of Hard Real Time System.
- Soft Real Time System does not guarantee that task will be completed in defined time. Online Transaction systems, Airline Ticket Reservation, etc. are the examples of Soft Real Time System.
- Software Installation means to put something in a new place, ready to be used.

- Office Automation Software is a group of computer programs that help office workers in their daily work.
- MS Office 2010 contains MS Word, MS Excel, MS PowerPoint and MS Outlook.
- For MS- Office 2013 the minimum requirements are: 1.6 GHz processor, 1 GB RAM, 3 GB hard disk, minimum Windows 7 operating system and graphics driver.

EXERCISE

A. Choose the right answer:

1. The software which performs all basic tasks is:
   a) antivirus b) start menu
   c) operating system d) office automation

2. A program that enables user to interact with computer is called:
   a) my document b) start menu
   c) desktop d) interface

3. The process of checking computer, starting operating system and making it ready to work is referred to as:
   a) resource management b) booting
   c) error checking d) file management

4. The number of user(s) that can access the resources simultaneously on a Multiuser OS is /are:
   a) one b) two
   c) many d) only administrators

5. Which management controls the dynamic allocation and de-allocation of processor, memory, etc?
   a) Resource b) File
   c) I/O d) User

6. In which operating system jobs are executed in groups?
   a) Batch Processing b) Time Sharing
   c) Single User d) Real Time

7. The system that guarantees that critical tasks should be completed without shortest delay is:
   a) Batch Processing b) Hard Real Time
   c) Soft Real Time d) Time Sharing

8. DOS is an example of:
   a) Real Time Processing OS b) Multi Processing OS
   c) Single User OS d) Multi User OS

9. The group of programs that helps office workers to do a number of routine tasks easily and efficiently is called:
   a) operating system b) e-mail
   c) anti-virus d) office automation

10. The operating system that allows frequent switching from one task to another is:
    a) Batch Processing b) Real Time Processing
    c) Single User d) Time Sharing

B. Respond the following:

1. Define Operating System. Give three examples of operating systems.
2. List the functions of an OS? Write briefly about any two.
3. Differentiate between CLI and GUI. Write any two benefits of each.
4. Which resources are managed by Resource Management function of OS?
5. What is the difference between single user and multi user OS? If you are a manager of a large organization which type of OS will you prefer? Justify your answer with any two reasons.
6. What is the purpose of office automation software? With examples, explain how can office automation help employees to be productive and efficient?
7. List the programs available in MS Office and write why each program is used?
8. What is the major difference between Soft Real Time and Hard Real Time systems?
9. Why it is important to install an antivirus?

C. Match the columns:

S.NO.	A	S.NO.	B	C
(i)	CLI	(a)	Time bond operating system	
(ii)	Windows	(b)	Office automation	
(iii)	Process	(c)	Function of operating system	
(iv)	Ms Excel	(d)	Operating system	
(v)	Real time processing operating system	(e)	A job to be performed by the system	
(vi)	Input / Output Management	(f)	Interface	

ACTIVITIES

1. Teacher should demonstrate installation process of
   - Windows Operating System (feasible version)
   - Microsoft Office (feasible version)
   - Any free antivirus software
2. Students should be given task to make use of antivirus software.
3. Student should observe and work with different
   - icons on Windows Desktop
   - Start Menu
   - Utility Programs available
4. Student should also practice creating, copying, moving and deleting files and folders.
5. Teacher should also demonstrate the Task Manager for explaining Task Management concept.
6. Teacher should also demonstrate the BIOS screen.

OFFICE AUTOMATION

Unit 3

SLOs

- Demonstrate Page Layout Tab of MS Word
- Identify the different groups of Page Layout Tab
- Apply different features available in groups of Page Layout Tab

3.1 MS WORD



Figure 3.1
MS Word 2010

Microsoft Word (MS Word) is one of the most famous word-processing software. It was first released and made public in early 1980s by Microsoft. It allows its user to type text and manipulate it. MS Word first introduced the concept of WYSIWYG (What You See Is What You Get) by introducing text formatting and document preview exactly as we would get it on a paper. It has advanced features like tables, images, advanced formatting and reviewing that give its users the ability to customize their documents as required. Even most of this book has been written, edited and formatted on MS Word. Latest versions of MS Word come as a part of Microsoft Office Suite (which includes other software as well like MS Excel and MS PowerPoint). MS Word is still most widely used word-processing software in the world. We will be using MS Word 2010 version in this chapter.

3.1.1 Page Layout Tab

The Page Layout Tab allows user to control the look and feel of his or her document. User can set margins, apply themes, control page orientation and size, add sections and line breaks, display line numbers, and set paragraph indentation and lines. The Page Layout tab has five groups of related commands namely Themes, Page Setup, Page Background, Paragraph and Arrange.



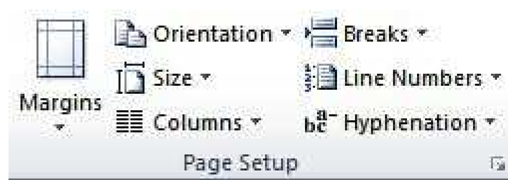
Figure 3.2 Page Layout tab

(i) Themes Group



A theme is a predefined set of formatting, colors and settings that changes the overall design and look of the entire document. Applying themes to our work gives it a professional look. There are different themes available relevant to the type of document being composed.

(ii) Page Setup Group



Page Setup settings help us set the page layout properties such as margins, orientation and size. The settings in this section are often applied throughout the document.

	**Margins** (HOTKEY: ALT+P+M) A margin is the area or space between the main content of a page and the page edges. This button is used to change the margins of the entire document or selected section.
	**Orientation** (HOTKEY: ALT+P+O) Page orientation or print orientation is the placement of contents on a page. This button sets the contents of the page or section in portrait (Vertical) or landscape (Horizontal) layouts.
	**Size** (HOTKEY: ALT+P+S+Z) The size button is used to choose the size of the paper for current section or entire document.
	**Columns** (HOTKEY: ALT+P+J) This button is used to split the text into two or more vertical columns.
	**Breaks** (HOTKEY: ALT+P+B) Breaks button is used to insert page, section or column breaks in the document.
	**Line Numbers** (HOTKEY: ALT+P+L+N) This button is used to add line numbers on the left side of each line of the document.
	**Hyphenation** (HOTKEY: ALT+P+H) This button is used to specify how hyphenation in a document should be applied.

(iii) Page Background Group

These settings are used mostly for special documents such as certificates, invitations, brochures, essays, etc. It consists of 3 buttons namely, Watermark, Page Color and Page Borders.



	**Watermark** (HOTKEY: ALT+P+P+W) A watermark is a faded background image that displays behind the text in a document. This button is used to insert logos, images or text behind the contents of a page.
	**Page Color** (HOTKEY: ALT+P+P+C) This button is used when user wants to apply a color for the background of the page.
	**Page Border** (HOTKEY: ALT+P+P+B) Page Border button is used to put a border around the page.

(iv) Paragraph Group

The Paragraph Group is where we can modify all the settings of the paragraphs that appear in our document. This allows us to set a few basic paragraph styles and also adjust the indents and spacings.

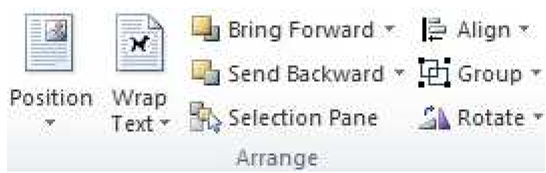


	**Indent Left** (HOTKEY: ALT+P+I+L) Indent Left is used to define amount of blank space (in centimeters) used to separate a paragraph from left margin.
	**Indent Right** (HOTKEY: ALT+P+I+R) Indent Right is used to define amount of blank space (in centimeters) used to separate a paragraph from right margin.

	**Space Before** (HOTKEY: ALT+P+S+B) Space Before is used to indicate how much space (in points) is added before the selected paragraph.
	**Space After** (HOTKEY: ALT+P+S+A) Space After is used to indicate how much space (in points) is added after the selected paragraph.

(v) Arrange Group

The buttons in Arrange Group help the users to quickly arrange graphical and other elements of the document in relation to the main textual content.



	**Position** (HOTKEY: ALT+P+P+O) Position is used to place an object (picture or shape) on the page wherever you want.
	**Wrap Text** (HOTKEY: ALT+P+T+W) Text wrapping is used to arrange the text around an object like an image.
	**Bring Forward** (HOTKEY: ALT+P+A+F) Brings a selected object in front of all other objects.
	**Send Backward** (HOTKEY: ALT+P+A+E) Sends a selected object behind all other objects.
	**Selection Pane** (HOTKEY: ALT+P+A+P) Selection Pane is used to select, show, hide and change the order of objects in the document.
	**Align** (HOTKEY: ALT+P+A+A) Align is used to place objects like pictures, shapes, icons, etc. in alignment with margins, edge, or relative to another object in the document.

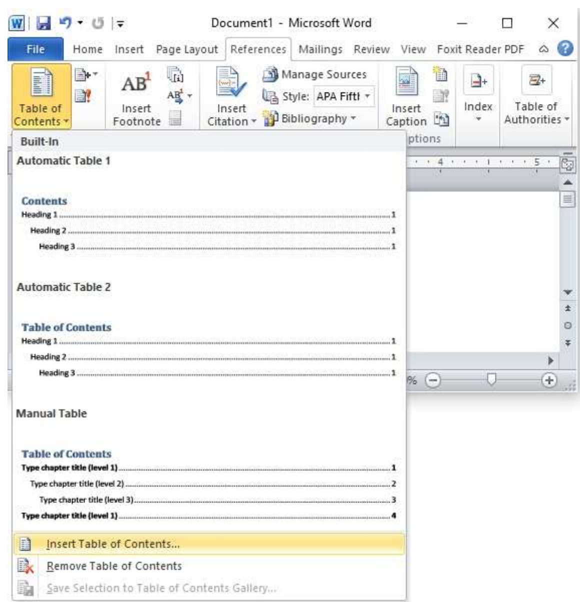
	**Group** (HOTKEY: ALT+P+A+G) Group is used to combine two or more objects together so that they can be treated as a single object.
	**Rotate** (HOTKEY: ALT+P+A+Y) Rotate is used to rotate or flip the selected object.

SLOs

- Insert manual and automatic table of contents in a document.
- Compose in Urdu and Sindhi languages in MS Word.

3.1.2 Table of Contents (ToC)

A Table of Contents (ToC) is an organized listing of the sections, groups and headings of content in a document and identified by page numbers where they are placed. It provides an overview of the document and allows readers to go directly to specific section or content in the document. ToC usually appears after the Title Page in a document. MS Word 2010 provides an advanced feature for automatically creating a ToC. A user can create an Automatic or a Manual table of contents in a document.



To create a Table of Contents in MS Word document, go to the References Tab where Table of Contents button appears as the first option of that tab. MS Word provides several options of creating a ToC that include Automatic Table creation, Manual Table creation or the user can even create a Customized Table of Contents based on the requirements of the document.

(i) Automatic Table

Automatic Table creates a Table of Contents automatically based on the content used as Heading presets of MS Word. Based on the type of

Heading, Automatic Table of Contents will create the appropriate levels and show page numbers where those Headings are placed. The only difference between Automatic Table 1 and Automatic Table 2 is the title of the table that is "Contents" or "Table of Contents".

(ii) Manual Table

Choosing Manual Table from the Table of Contents menu will create a template of a generic table of contents. This table will need to be edited and defined manually by providing all the headings, sub-headings and page numbers. To extend the table, simply copy and paste the template lines and edit them to preserve proper formatting.

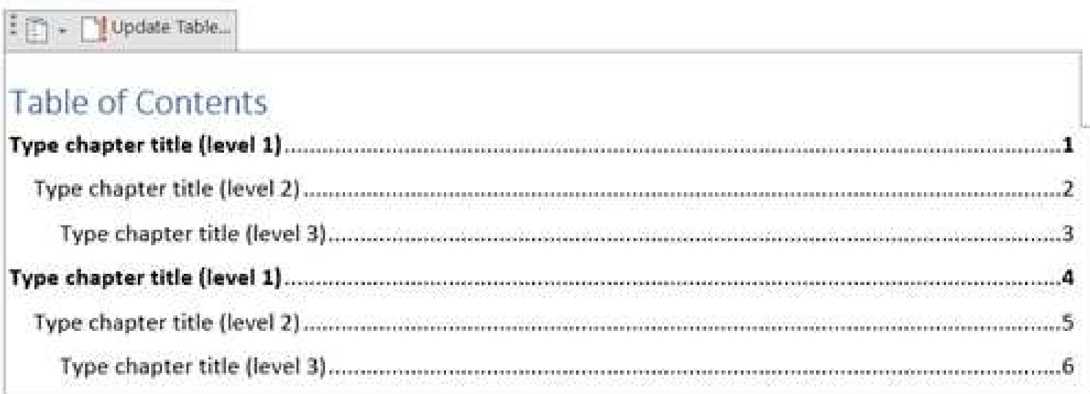


Table of Contents

Type chapter title (level 1)........1
Type chapter title (level 2)........2
Type chapter title (level 3)........3
Type chapter title (level 1)........4
Type chapter title (level 2)........5
Type chapter title (level 3)........6

3.1.3 Typing in Urdu and Sindhi Languages

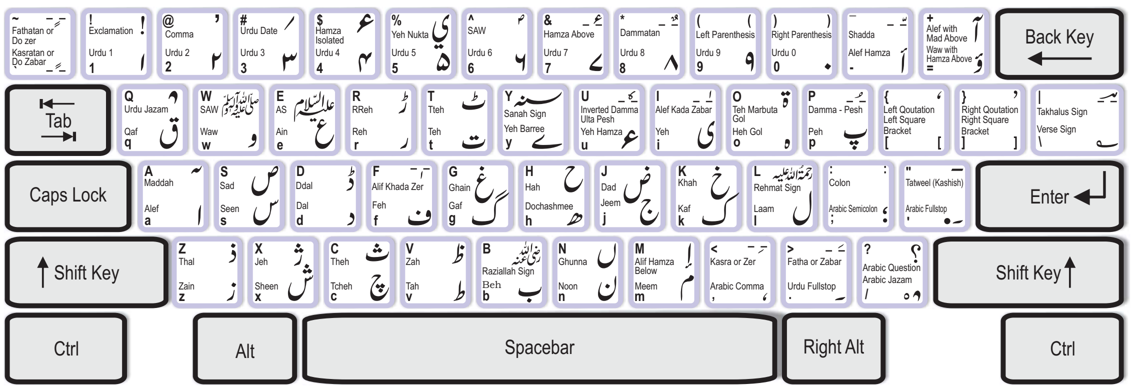
MS Word 2010 helps in writing letters, applications, CVs, question papers and books in default language set by Microsoft Windows (that is usually English). MS Word 2010 also supports typing text in various other languages like Urdu and Sindhi. To be able to write in other languages, the keyboards for those languages have to be installed in Microsoft Windows. MS Word also supports changing and setting its default language. To change the default language, go to the File menu and select Options. From the Word Options dialog box, select Language tab. Now choose one of the available languages as the default language for MS Word 2010.

Teacher Note

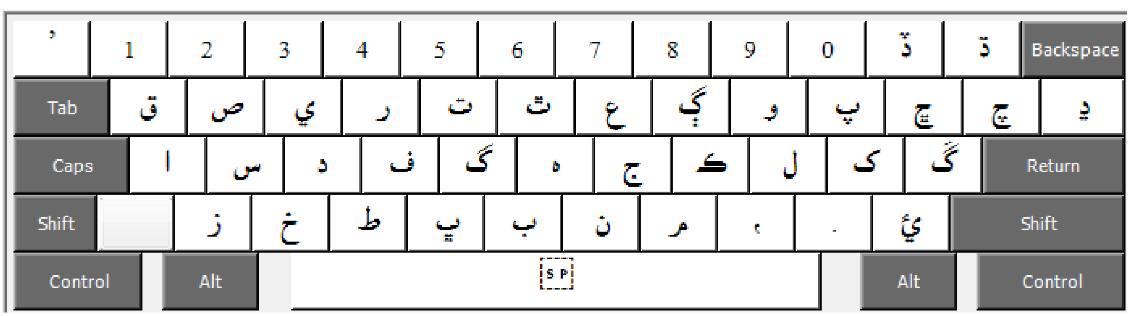
Teachers are required to demonstrate the installation of multiple languages like Urdu and Sindhi in Microsoft Windows. They can do so by adding languages from the Regional Settings of Windows Control Panel. Installation of these languages also installs their keyboard layouts and enables the ability to type text in those languages.

Urdu Keyboard Layout

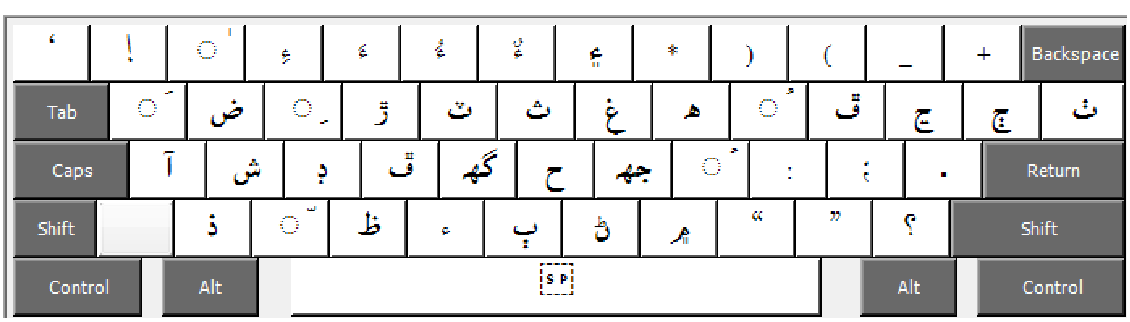
Urdu Phonetic Unicode Keyboard Layout (With SHIFT) (for regular Urdu alphabets)



Sindhi Keyboard Layout



Normal State



Shift State

SLOs

- Review the basics of MS Excel
- Identify the Elements of MS Excel User Interface
- Display data with charts

3.2 MS EXCEL 2010

Microsoft Excel (MS Excel) is a software that uses spreadsheet system to organize, display, format and calculate data using advanced features and formulas. MS Excel is a part of Microsoft Office Suite and integrates with other applications in the Office Suite. MS Excel offers advanced features to perform calculations, visualize data in graphs and create pivot tables. It efficiently makes use of spreadsheets to organize, analyze and store data in tabular and graphical forms. It is the most widely used spreadsheet system and has a high demand in many organizations for keeping records of data and presenting them as tables and graphs.

3.2.1 MS Excel User Interface

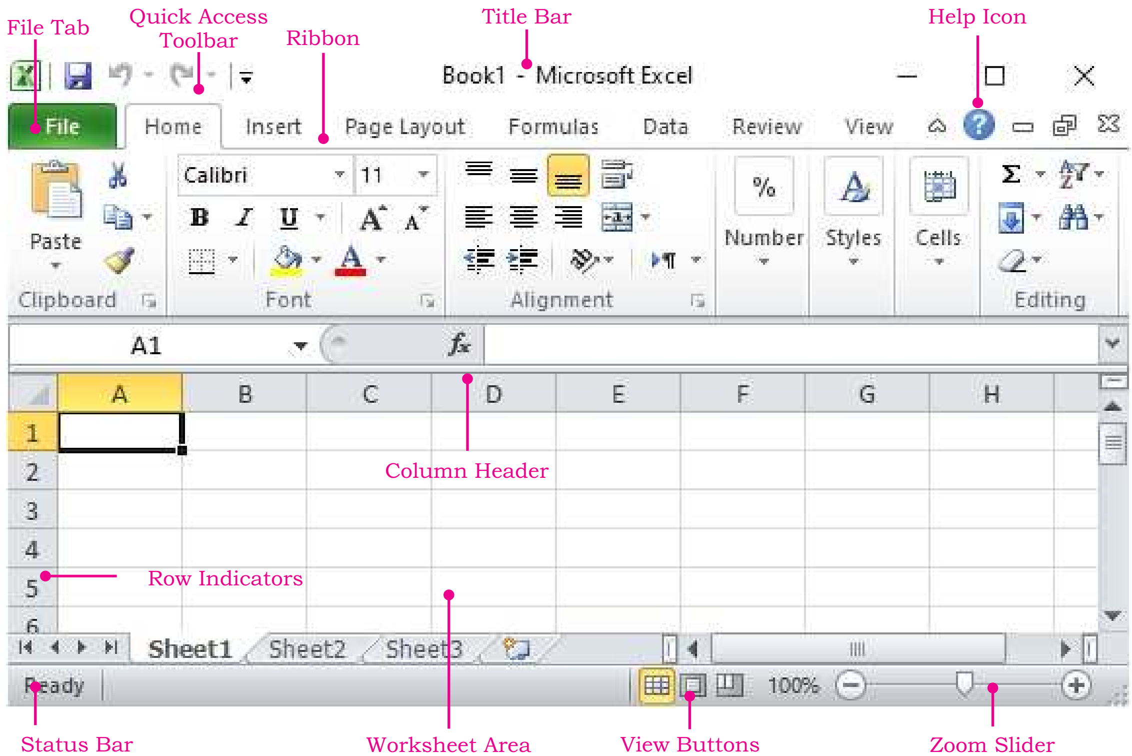
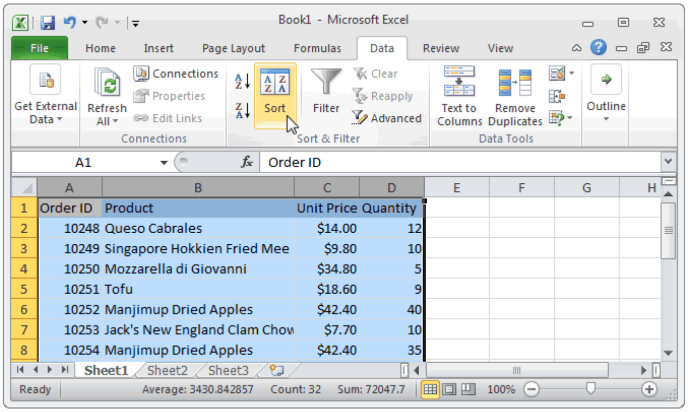


Fig: 3.3 MS Excel Screen

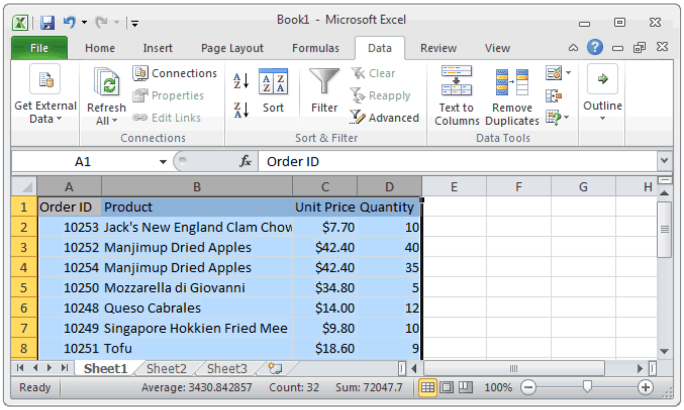
3.2.2 Sorting

Sorting is the process of rearranging or reordering data based on different criteria like size, quality, value and quantity. MS Excel has the ability to sort data according to the needs of the user. To help better understand this concept, take or create a list of products with their unit prices and quantities as shown below.

The objective is to sort this list of products with prices and quantities, in alphabetical order based on the names of the products. To achieve this, first select all the rows and columns which make up this product list then go to the Data tab and select the Sort option.



In the Sort dialog box, choose Product from the Sort by dropdown list and make sure that in the Order dropdown list, A to Z is selected.



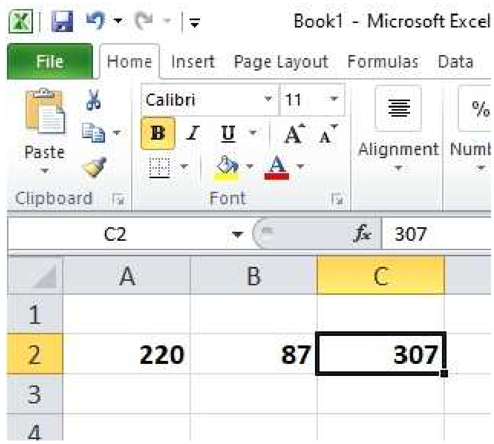
Your data will be rearranged and sorted alphabetically based on the values in Product column and their respective prices and quantities will also be rearranged as sorted data as shown in the figure here. This data can also be sorted in terms of unit price and quantity.

3.2.3 Formulas

MS Excel 2010 allows its user to perform numerous calculations on data. Common calculations include addition, subtraction, multiplication and division. Comparison of two numbers and finding their average is also

possible. Formulas tell MS Excel what calculation needs to be performed on the data. Formulas always start with an equal sign (=). They are defined in the Formula Bar.

To understand this concept, take an example of two numbers, which are 220 and 87, placed in columns A2 and B2, respectively. The objective is to add these two numbers using MS Excel formula. To achieve this, follow these steps:



1. Select cell C2.
2. Type = (equal sign).
3. Select cell A2 in the worksheet by using the mouse or the keyboard. This action places the cell reference A2 in the formula of selected cell.
4. Type +.
5. Select cell B2 in the worksheet by using the mouse or the keyboard to put that cell's reference in the formula of selected cell.
6. Press Enter.
7. The answer (307) will be calculated by MS Excel and displayed in the selected cell (C2) where the addition formula was composed. Likewise subtraction, multiplication, division and other mathematical functions can be applied.

3.2.4 Charts

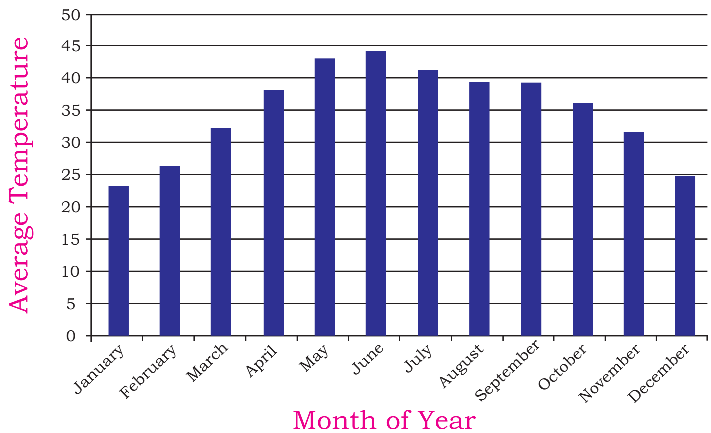
Charts are also known as graphs. They include diagrams and tables. Charts feature in MS Excel allows the users to present a set of data visually. A huge set of data may not succeed in presenting its meaning to the reader whereas visual information helps better understand those data values at a glance. To understand this concept, take an example of the average monthly temperature for Larkana in 2018 as shown below:

	Month	Temp		Month	Temp
1	January	23°C	7	July	41°C
2	February	26°C	8	August	39°C
3	March	32°C	9	September	39°C
4	April	38°C	10	October	36°C
5	May	43°C	11	November	31°C
6	June	44°C	12	December	24°C

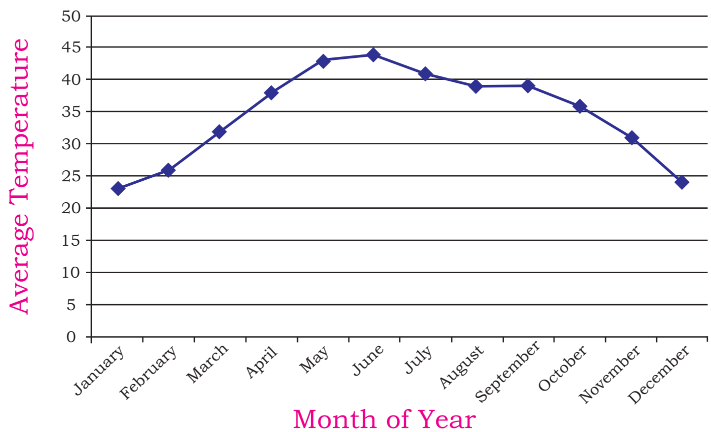
The temperature table contains data in a form which is not very helpful for every user to understand. If the same data is converted into a graph or chart, the user would be better able to reach a conclusion. From the bar chart, we can easily derive the hottest and the coldest months and compare them with each other.

The same data, if displayed as a graph or chart, will give more meaning and a user can easily derive an understanding of such values at a glance as seen in the below figures.

Annual Temperature of Larkana (Bar Chart)



Annual Temperature of Larkana (Line Chart)



Making this chart is very easy . All we need to do is to select the table and click at chart button.

There are many types of Charts. Four most common types of chart used are: Bar Charts, Column Charts, Line Charts and Pie Charts.

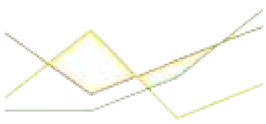
SUMMARY

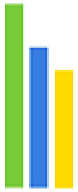
- MS Word is widely used word processing software in the world.
- The Page Layout Tab has five groups of related commands namely: Themes, Page Setup, Page Background, Paragraph and Arrange.
- Themes Group is a predefined set of formatting, colors and settings that changes the overall design and look of the entire document.
- Page Setup settings help us set the page layout properties such as margins, orientation and size.
- Page Background Group consists of 3 buttons namely, Watermark, Page Color and Page Borders.
- The Paragraph Group allows you to set a few basic paragraph styles and also adjust the indents and spacing.
- Arrange Group helps the users to quickly arrange graphical and other elements of the document in relation to the main textual content.
- A Table of Contents (ToC) is an organized listing of the sections, groups and headings of content in a document, identified by page numbers where they are placed
- Typing in Urdu and Sindhi Languages: Change the default language, go to the File menu and select Options. From the Word Options dialog box, select Language tab.
- Microsoft Excel is a software that uses spreadsheet system to organize, display, format and calculate data using advanced features and formulas.
- Sorting is the process of rearranging or reordering data based on different criteria like size, quality, value and quantity.
- Formulas help user to perform different types of calculation easily.
- MS Excel 2010 allows its user to perform numerous calculations on its data
- Charts are also known as graphs. They are used to show data graphically.
- There are many types of Charts. Four most common types of chart used are Bar Charts, Column Charts, Line Charts and Pie Charts.

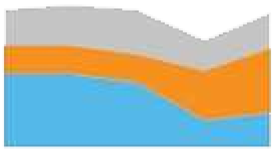
EXERCISE

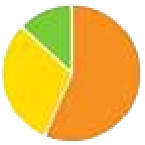
A. Choose the right answer:

1. Which chart will be suitable to show the share of three partners in a business?

a) 

b) 

c) 

d) 

2. The software that is used for accounting purpose is:
   a) MS Word b) MS Excel
   c) MS Power point d) MS Access

3. The software that is used to format a document is:
   a) MS Word b) MS Excel
   c) MS Power point d) MS Access

4. The special character that initiates the formula mode in a cell is:
   a) / b) =
   c) - d) *

5. The function which is used to re-arrange data according to specific criteria is called:
   a) Filtering b) Sorting
   c) Organizing d) Grouping

6. If we want to change the overall design of a word document, we should use:
   a) themes b) page layout
   c) watermark d) margins

7. The correct formula to calculate the total in the given table is:

	A	B	C	D	E	F
1	Name	English	Sindh/Urdu	Maths	Science	Total
2	Ghulam Shabir	40	41	41	40	
3	Riaz Hussain	41	39	34	38	
4	Nabil Ahmed	41	35	32	40	
5	Anwar Ali	40	38	33	37	

a) = B2 + C2 + D2+ E2   b) = B2 + E2
c) = sum (B2 to E2)   d) = sum (B2 from E2)

8. The correct formula to calculate the percentage in the given table is:

	A	B	C	D	E	F
1	Name	English	Sindh/Urdu	Maths	Science	Per
2	Ghulam Shabir	40	41	41	40	
3	Riaz Hussain	41	39	34	38	
4	Nabil Ahmed	41	35	32	40	
5	Anwar Ali	40	38	33	37	

a) =B2 + C2 + D2+ E2 / 400 * 100
b) =B2 + C2 + D2+ E2 * 100
c) =(B2 + C2 + D2+ E2) / 400 * 100
d) =(B2 + C2 + D2+ E2) / 100 * 400

9. Charts are basically used to
a) design tables
b) organize data in tables
c) Sort data in different columns
d) show the quantities and their relationships graphically

10. To apply the table of contents automatically, the most important task is to properly define the
a) levels of heading   b) page numbering
c) page layout   d) themes

B. Respond the following:

1. What is a word processor? Write any three applications of a word processor.
2. Discuss the Margins and Paper Size options in the Page Setup group.
3. Name and describe two options in Orientation.
4. How can we apply Margins in a document?
5. Describe the different types of breaks in MS Word.
6. Differentiate "Bring Forward" and "Send Backward" options in the Arrange group with example.

7. Explain the "Columns" option in the Page Setup group.
8. List and define Position and Wrap Text option in Arrange Group.
9. In what way does a ToC help book reader?
10. Write steps that will multiply 37 by 15 using the formula bar in MS Excel.
11. Why do we use Watermark in a document? Give some examples of Watermarks.
12. List four uses of spreadsheets in business.

C. Match the columns:

S.NO.	A	S.NO.	B	C
(i)	Wrap Text	(a)	documentation	
(ii)	Automatic Table of Contents	(b)	allows to arrange text around an image	
(iii)	Page Setup Group sets	(c)	Show data graphically	
(iv)	Excel is used to	(d)	is created based on heading	
(v)	Charts	(e)	margins, orientation and size	
(vi)	Ms Word is widely used for	(f)	organize, display, format and calculate data	

ACTIVITIES

1. Compose a document in MS Word and apply Watermark, Page Color and Page Border.
2. Apply different options of Margins, Orientation, Size and Columns in a document.
3. Add a) 15 Names and b) 15 Marks Obtained in two columns and apply different sorting options in MS Excel.

4. Type the following text in MS Word using Urdu or Sindhi language facility.

ماهرن مطابق فائيوجي ٽيڪنالاجي جي عام ٿيڻ سان دنيا ۾ ٽي وڏيون تبديليون ٿي سگهن ٿيون.

هڪ ته انٽرنيٽ جي اسپيڊ ڏاڍي تيز ٿي ويندي جنهن سان آن لائن ويڊيو ايڊيٽنگ ۽ گڏ ڪم ڪرڻ آسان ٿي ويندو.

ٻيو ته انٽرنيٽ ڊيوائس سان منزل تائين پيغام پهچڻ وارو وقت تمام گهٽ لڳندو جنهن سبب سرجنز گهڻو پري وارن علائقن ۾ ويهي ائين سرجري ڪندا جيئن هو پاڻ اتي موجود هجن. ورچوئل ريئلٽي جي ذريعي راند روند ڪري سگهبي.

ٽيون مشينن سان ڪنڪشن ۾ بهتري ايندي جنهن سان انٽرنيٽ آف ٿنگس (آئي او ٽي) جي ميدان ۾ وڏي ترقي جي توقع آهي.

فائيوجي اچڻ سان هيءَ اميد ڪئي وڃي ٿي ته روبوٽڪس، انٽرنيٽ آف ٿنگس، ٽرانسپورٽ، طب ۽ انسانن جي لاءِ خطرناڪ شعبن ۾ مشينن جو استعمال ممڪن ٿي ويندو.

ماہرین کے مطابق فائیو جی ٹیکنالوجی کے عام ہونے سے ساری دنیا میں بڑی تبدیلیاں متوقع ہیں۔

پہلے تو یہ کہ انٹرنیٹ کی اسپیڈ بہت زیادہ تیز ہو جائے گی جس سے آن لائن ویڈیو ایڈیٹنگ اور مشترکہ کام کرنا آسان ہو جائے گا۔

دوسرے انٹرنیٹ ڈیوائس سے منزل تک پیغام پہنچانے کا وقت کم ہو جائے گا جس سے سرجنز دور دراز علاقوں میں اس طرح آپریشن کر سکیں گے جیسے وہاں موجود ہوں۔ ورچوئل رئیلٹی کے ذریعے کھیل کھیلے جا سکیں گے۔

تیسرے مشینوں سے کنکشن میں بہتری سے (آئی او ٹی) کے میدان میں بڑی ترقی کی توقع ہے۔

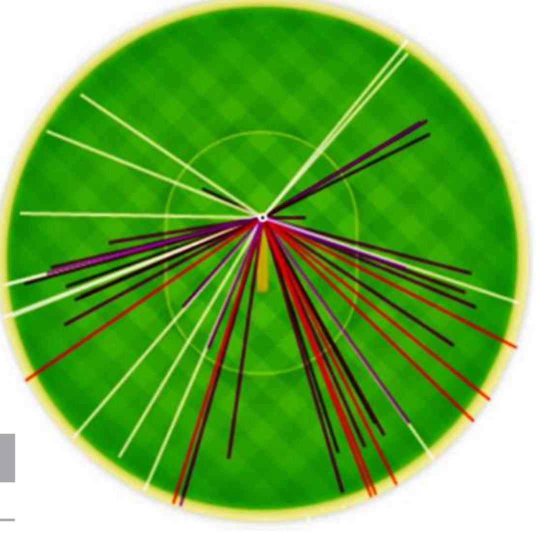
فائیو جی کے آنے سے امید ہے کہ روبوٹکس، انٹرنیٹ آف تھنگس، ٹرانسپورٹ، طب اور انسانوں کے لئے خطرناک شعبوں میں مشینوں کا استعمال ممکن ہو گا۔

5. Using the following pie chart, prepare an excel sheet to calculate:

(a) How many runs came for ones, twos, fours and sixes?

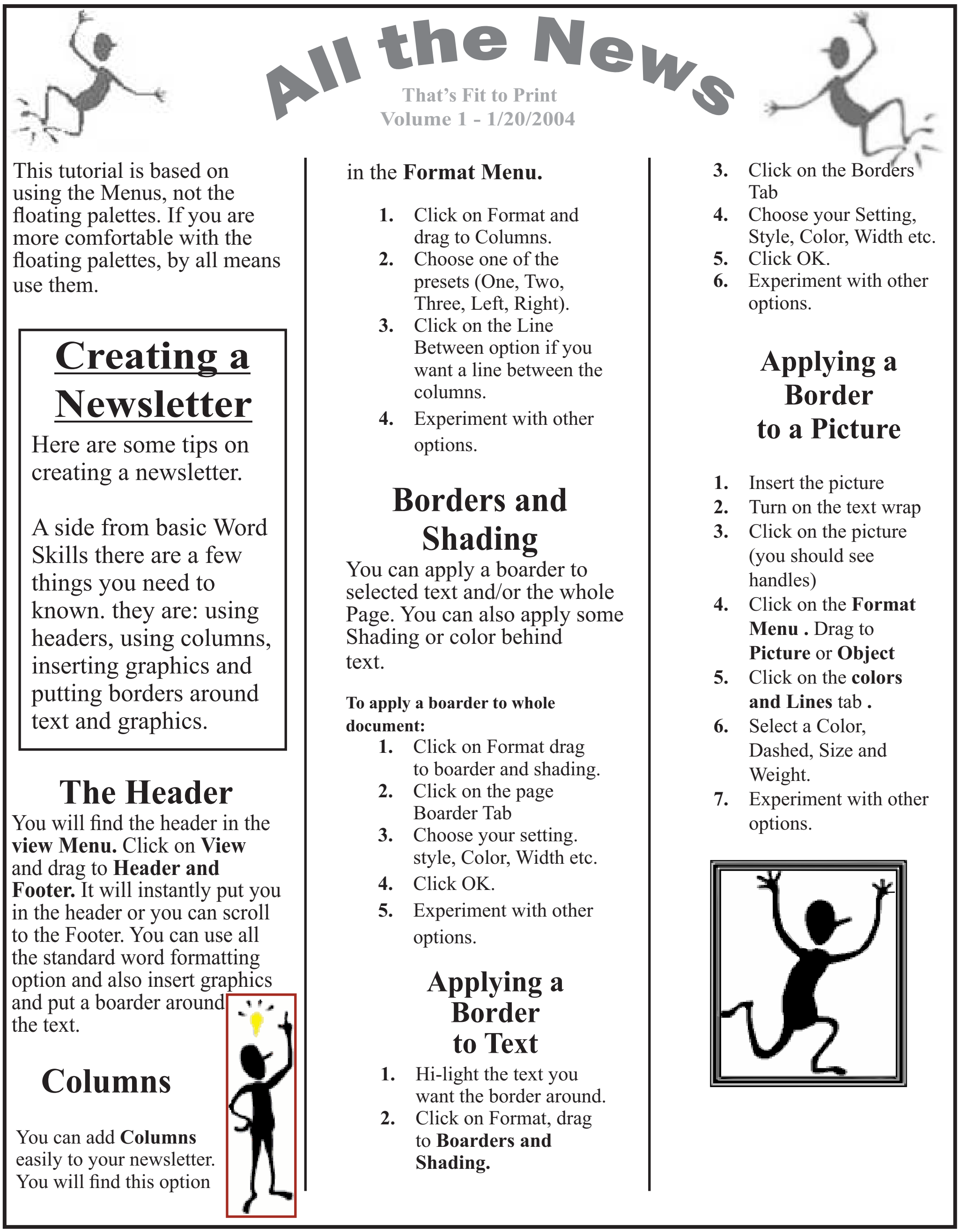
(b) The strike rate of the player.

(c) Using the scores prepare a pie chart to show the share of ones, twos, three, fours and sixes in score of 149.



1s	2s	3s	4s	5s	6s	Runs	BF
21	7	0	14	0	9	**149**	64

6. Create a newsletter in MS Word using your knowledge. The newsletter is required to have a header, three columns, and some graphics with text wrapped around them. The final result may look like:



All the News

That's Fit to Print

Volume 1 - 1/20/2004

This tutorial is based on using the Menus, not the floating palettes. If you are more comfortable with the floating palettes, by all means use them.

Creating a Newsletter

Here are some tips on creating a newsletter.

A side from basic Word Skills there are a few things you need to known. they are: using headers, using columns, inserting graphics and putting borders around text and graphics.

The Header

You will find the header in the **view Menu.** Click on **View** and drag to **Header and Footer.** It will instantly put you in the header or you can scroll to the Footer. You can use all the standard word formatting option and also insert graphics and put a boarder around the text.

Columns

You can add **Columns** easily to your newsletter. You will find this option in the **Format Menu.**

1. Click on Format and drag to Columns.
2. Choose one of the presets (One, Two, Three, Left, Right).
3. Click on the Line Between option if you want a line between the columns.
4. Experiment with other options.

Borders and Shading

You can apply a boarder to selected text and/or the whole Page. You can also apply some Shading or color behind text.

To apply a boarder to whole document:

1. Click on Format drag to boarder and shading.
2. Click on the page Boarder Tab
3. Choose your setting. style, Color, Width etc.
4. Click OK.
5. Experiment with other options.

Applying a Border to Text

1. Hi-light the text you want the border around.
2. Click on Format, drag to **Boarders and Shading.**
3. Click on the Borders Tab
4. Choose your Setting, Style, Color, Width etc.
5. Click OK.
6. Experiment with other options.

Applying a Border to a Picture

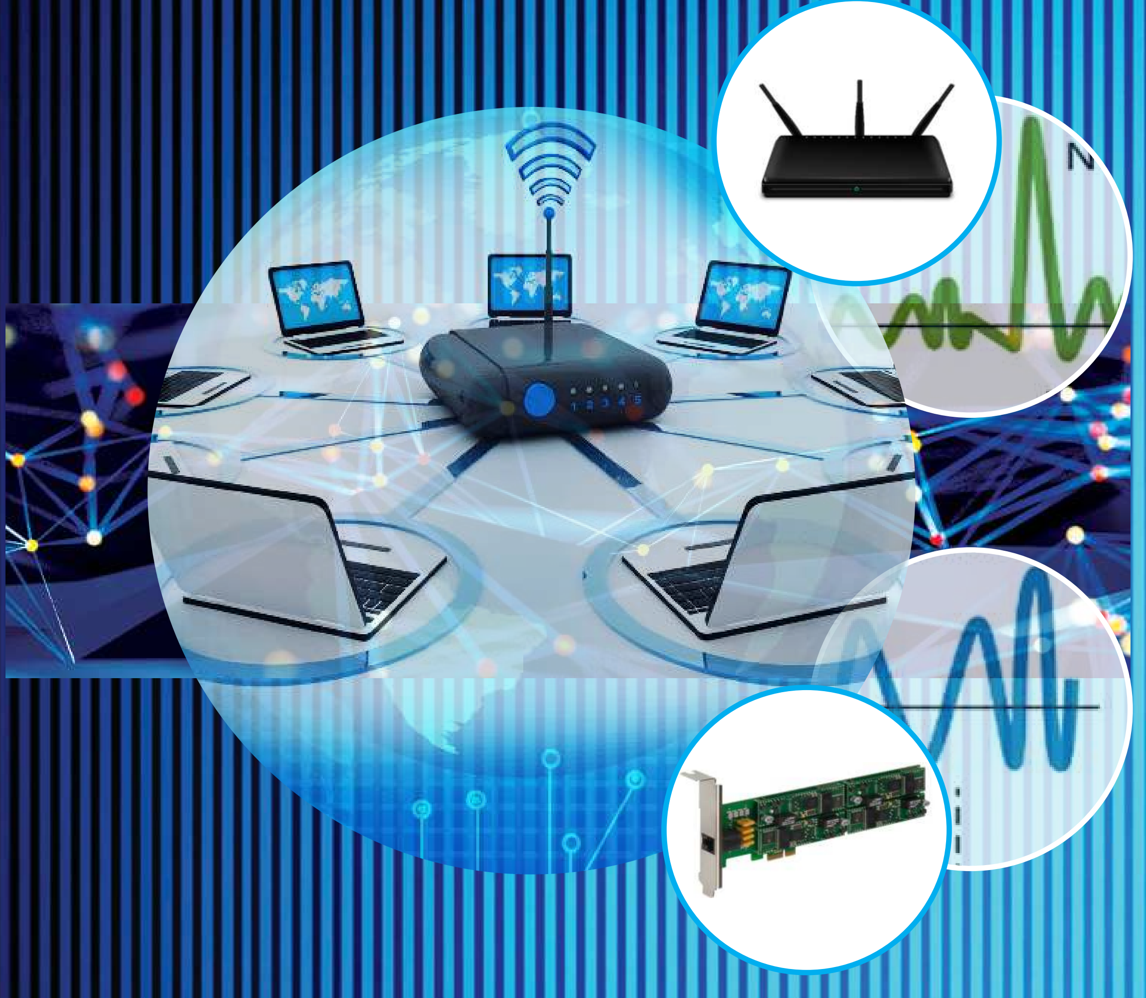
1. Insert the picture
2. Turn on the text wrap
3. Click on the picture (you should see handles)
4. Click on the **Format Menu .** Drag to **Picture** or **Object**
5. Click on the **colors and Lines** tab **.**
6. Select a Color, Dashed, Size and Weight.
7. Experiment with other options.

7. Create a spreadsheet of employees' payroll in MS Excel. The spreadsheet should meet the following requirements:
   - The columns should include Emp ID, Emp Name, Dept, Basic Pay, Medical Allowance, Conveyance Allowance, House Rent, Gross Salary, Income Tax and Net Salary.
   - As User enters Basic Pay, rest of the columns should be calculated automatically.
   - The calculation should be done on following method:

Columns for Calculation	**Criterion**
Medical Allowance (MA)	15% of Basic Salary
Conveyance Allowance (CA)	22.5% of Basic Salary
House Rent (HR)	40% of Basic Salary
Gross Salary	Sum of Basic Pay, MA, CA, HR
Income Tax	7.5% of Gross Salary
Net Salary	Amount after deduction of Income Tax

DATA COMMUNICATION AND COMPUTER NETWORK

Unit 4



SLOs

- Define the basic terminology of data communication
- Elaborate the terms data rate and baud rate with corresponding formulas and standard units
- Differentiate between analog and digital signals
- Distinguish between data rate and baud rate

4.1 BASICS OF DATA COMMUNICATION

Communication is the process of sharing a message. A conversation between two people is an example of communication. Data communications refers to the sharing of a virtual message. Electronic communications, like emails and instant messages and phone calls are examples of data communications. Data communication is the exchange of digital messages between two devices. It involves a sender and a receiver which communicate via some form of transmission medium such as a cable.

4.1.1 Basic Terminologies of Data Communication

In order to understand the data communication, it is good to know some basic terms related to it.

(i) Data

Collection of raw facts and figures is called data. The word data is derived from Latin language and it is plural of Datum. The text, numbers, symbols, images, voice and video which are processed by computers and digital devices are called data. Data can be considered as unprocessed information.

(ii) Data Communication

Data Communication is the process of transferring data electrically from one place to another. It is the process of exchange of data and information between two parties such as human and electronic or computing device.

(iii) Data Transmission

The data transmission means emission of data in any direction via wireless or wired medium. Transmission may occur between source and destination.

(iv) Analog Signals

Analog signals are a continuously varying signals or waves that change with time period and used to represent data. An analog signal can be used to measure changes in some physical quantities such as light, sound, pressure or temperature.

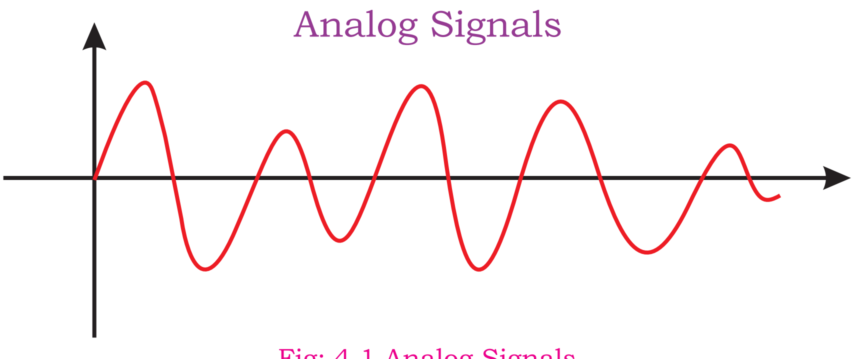


Fig: 4.1 Analog Signals

(v) Digital Signals

A digital signal is an electrical signal that is converted into a pattern of bits to represent a sequence of discrete values, at any given time. It can only be one of the finite numbers represented as 0 or 1.

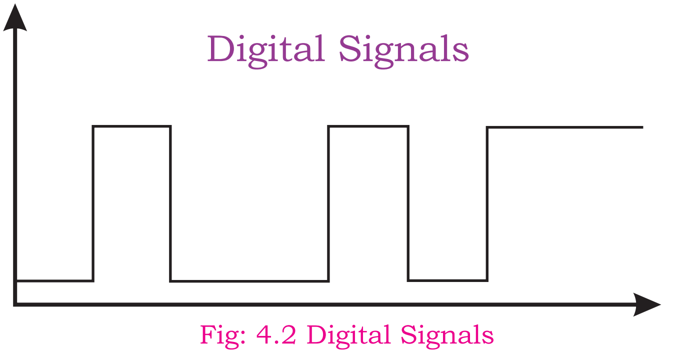


Fig: 4.2 Digital Signals

Difference between Analog and Digital Signals:

Analog Signal	Digital Signal
1 An analog signal is a continuous wave that changes by time period.	1 A digital signal is a discrete wave that carries information in binary form.
2 Analog signal has no fixed range.	2 Digital signal has a finite number i.e. 0 and 1.
3 An analog signal can easily be disturbed by other signals or waves.	3 A digital signal is less prone to other signals disturbance.
4 The human voice is example of an analog signal.	4 Signals used by computer are the digital signal.
5 An analog signal is represented by a sine wave.	5 A digital signal is represented by square waves.
6 Analog signals are long term waves need to be boosting.	6 Digital signals are short term signals remain within digital devices / electronic.

(vi) Data Rate / Bit Rate

Data rate is the rate at which data is transferred. It is normally measured in bits per second. Bit is the actual binary digit which is the basic unit of data transmission. Bit can hold either 0 or 1. Data rate can be ranging from bps (bits per second) for smaller values to kbps (kilo bits per second) and mbps (megabits per second). It is also called bit rate. Data rate becomes faster when more bits are transferred in one second.

Teacher Note

There are many abstract concepts in this chapter. It is good idea that teachers explain this chapter with the help of videos available on internet.

(vii) Baud Rate

The baud rate is the number of signals transmitted per second and one signal can represent one or more bits. It is used to describe the maximum change in an electronic signal. For example, if a signal changes 1200 times in one second, it would be measured at 1200 baud.

Difference between Data Rate and Baud Rate:

Data Rate or Bit Rate	Baud Rate
1 Bit rate tells the number of bits transmitted per unit of time (Second).	1 Baud rate is used when we want to know the number of signal units transmitted per unit of time (Second).
2 Bit rate is the number bits (0's and 1's) transmitted per second.	2 Baud rate is the number of times a signal is traveling comprised of bits. One signal can represent more than one bit.
3 Bit rate = baud rate x the number of bits per signal unit	3 Baud rate = bit rate / the number of bits per signal unit

(viii) Signal to Noise Ratio

Signal-to-noise ratio (abbreviated SNR or S/N) is a measure used in engineering that compares the level of a desired signal and the level of background noise. It is defined as the ratio of signal power to the noise power, often expressed in decibels.

SLOs
- Recognize different components of a communication system
- Tell the various properties of a good communication system

4.1.2 Components of a Communication System

A Communication system has following five components as shown in figure 4.3.

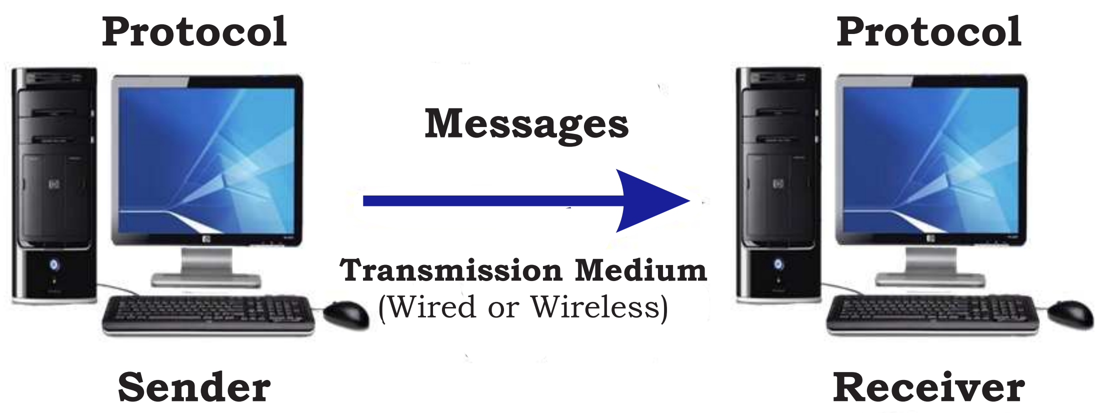


Fig: 4.3 Components of Communication System

(i) Message

It is the information or data to be communicated. Common forms of information include text, numbers, pictures, audio and video.

(ii) Sender

It is the device that generates and sends a message. It can be a computer, telephone handset, etc.

(iii) Receiver

Any particular digital electronic device which has capability to recieve data in form of message. The location of receiving computer is generally different from the sending computer. Like sender, it can also be a computer, telephone handset, etc.

(iv) Medium

It is the channel or path through which the message is carried from sender to the receiver. Some examples include twisted-pair cable, coaxial cable, radio waves, etc.

(v) Protocol

Protocols are the rules and procedures on which computers exchange data on network. Sender and receiver follow same protocols to communicate with each other. In other words, a protocol is an agreement between two parties or venders, using communication devices.

4.1.3 Properties of a Good Communication System

The effectiveness of a data communications system depends on the fundamental characteristics which include delivery, accuracy and timeliness.

Characteristic	Description
1. Delivery	Making sure that the data is delivered is the first fundamental characteristic of any communication network. The system must be able to deliver data in correct order to the correct destination.
2. Accuracy	The system must deliver the data accurately. Data that has been altered during transmission and left uncorrected is not useful.
3. Timeliness	The data must be delivered in a timely manner. Late delivered data is useless.

SLOs

- Develop understanding about the transmission medium
- Recognize and describe different types of guided and unguided media
- Differentiate between guided and unguided media

4.2 TRANSMISSION MEDIUM

Transmission Medium or Communication Channel is a wireless or physical path between the sender and receiver through which data is sent and received from one place to another. Data is transmitted normally by electromagnetic or electrical signals through different types of wires,

atmosphere or vacuum. Transmission media is broadly classified into two groups; guided and unguided as shown in figure 4.4.

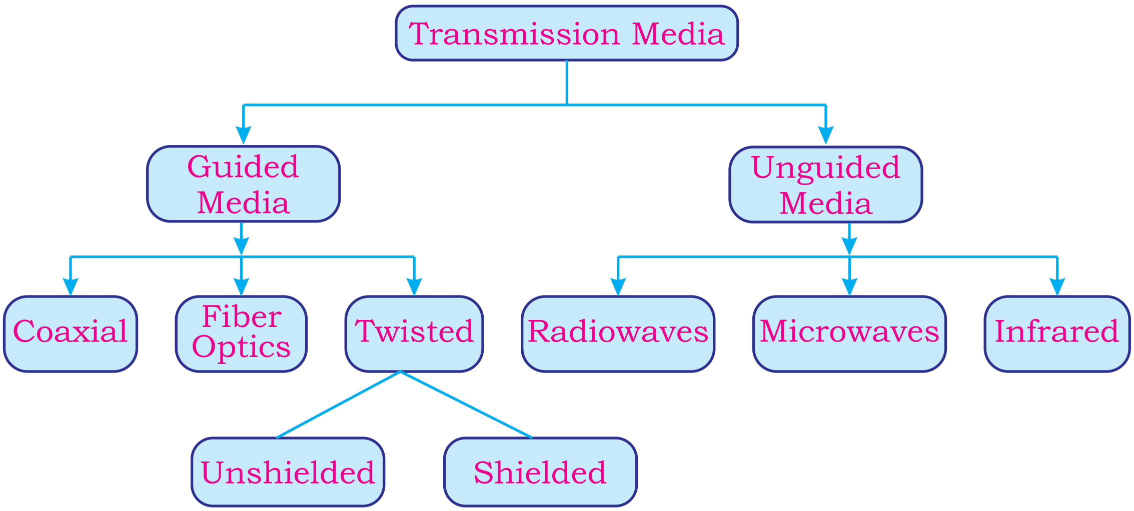


Fig: 4.4 Transmission Medium

4.2.1 Guided Media

In guided media signals are transmitted in a narrow pathway by using physical links. It is also called Wired or Bounded transmission media. The physical links are the cables that are tangible or have physical existence. There are three common types of guided media used for the networks. Each of them has its own characteristics like transmission speed, effect of noise, physical appearance, cost, etc.

(i) Twisted Pair Cable

As name suggests, this cable is made by two separate wires twisted together. A twisted pair cable is made up of insulated copper wires. The insulation and twisting of wires prevent external interference. Each pair of wires has unique color code. This type of cable is widely used in different kinds of data and voice infrastructures. There are two types of twisted pair cables:

(a) Unshielded Twisted Pair (UTP)

(b) Shielded Twisted Pair (STP)

(a) Unshielded Twisted Pair (UTP)

This type of cable can block interference but it is vulnerable to external interference. It is mostly used for telephonic applications. It is less expensive and easy to install.

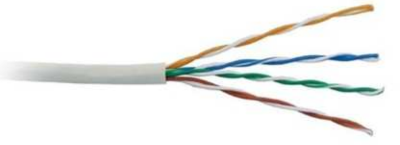


Fig: 4.5 Unshielded Twisted Pair (UTP)

(b) Shielded Twisted Pair (STP)

This type of cable consists of a special coating to block external interference. It is used in fast-data-rate ethernet and also in voice and data channels of telephone lines.



Fig: 4.6 Shielded Twisted Pair (STP)

(ii) Coaxial Cable

Coaxial cable is also known as coax. It has an outer plastic covering containing two parallel conductors each having a separate insulated protection cover. Cable TVs and analog television networks widely use coaxial cables.



Fig: 4.7 Coaxial Cable

(iii) Fiber-Optic Cable

In optical fiber or fiber-optic cable data is transferred in the form of light. It uses the concept of reflection of light through a core made up of glass or plastic. The core is surrounded by a less dense glass or plastic covering called the cladding. It is used for transmission of large volumes of data at very high speed.



Fig: 4.8 Fiber-Optic Cable

4.2.2 Unguided Media

Unguided media is also termed as wireless or unbounded transmission media. As the name implies, it does not require physical

medium such as wire for the transmission of electromagnetic signals. There are three major types of Unguided Media.

(i) Radio Waves

Radio waves are also called electromagnetic waves. These are easy to generate and can penetrate through buildings. Radio waves are omnidirectional and propagated in all directions. It means that sending and receiving antennas do not need to be aligned. FM, AM radios, television and cordless phones use radio waves for transmission.



Fig: 4.9 Radio Waves

(ii) Microwaves

Microwave transmission is a line of sight transmission i.e. the sending and receiving antennas need to be properly aligned with each other. The distance covered by the signal is directly proportional to the height of the antenna. These are mostly used for mobile phone communications tower and television broadcast. Terrestrial and Satellite are two types of microwave transmissions.

Terrestrial: Terrestrial microwaves have both stations having antennas on earth.

Satellite: In satellite system (Figure 4.10), some antenna are on satellite in orbit and others are on stations on earth. They work at remote places so it can be used in mobile devices.

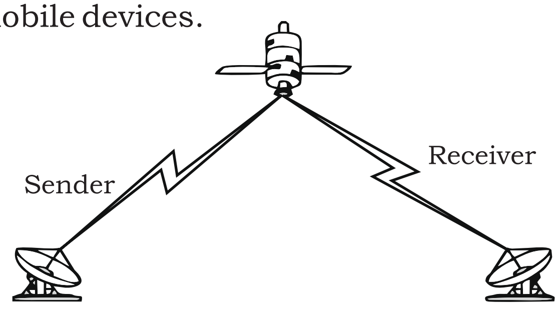


Fig: 4.10 Microwaves Transmission

(iii) Infrared

It uses infrared light to transmit signals. LED is used to transmit signals and light-receivers (photodiodes) to receive signals. They use terahertz frequency. It cannot penetrate walls or other objects. Infrared light is transmitted generally line of sight (point to point). Wireless infrared communications can be used to establish short range wireless links or wireless Local Area Network.



Fig:4.11 Infrared

SLO	• Describe the different types of flaws and faults in transmission signals.

4.2.3 Transmission Impairments

Sometimes, signals traveling through transmission media lose their quality. This means that received signal is not same as the signal that was sent. This phenomenon is called transmission impairments. Transmission impairments are those defects that occur when data is transmitted. There are three causes of impairment i.e. attenuation, distortion and noise.

(i) Attenuation

Attenuation means loss of energy. A signal loses its energy due to the resistance of medium while it is transmitted. Its strength decreases with increase in distance. Amplifiers are used to overcome attenuation and make signal stronger again. It is measured in decibels.

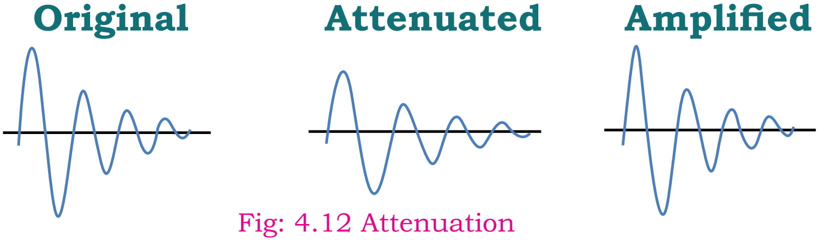


Fig: 4.12 Attenuation

(ii) Distortion

Distortion means change in the shape of the signal. A composite signal has several frequencies. When it travels through a medium different component of signal may reach at different time at destination because each component has different speed in that medium. This is called distortion. They have different phases at sender and receiver ends.

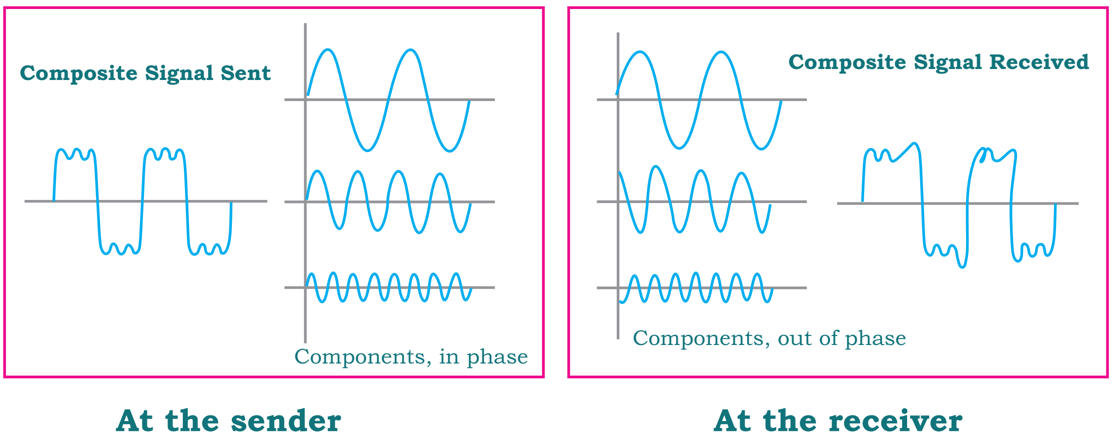


Fig: 4.13 Distortion

(iii) Noise

Unwanted signal that mixes up with the original signal during the transmission of data is called noise. It can be induced noise, crosstalk noise, thermal noise and impulse noise which may damage the signal.

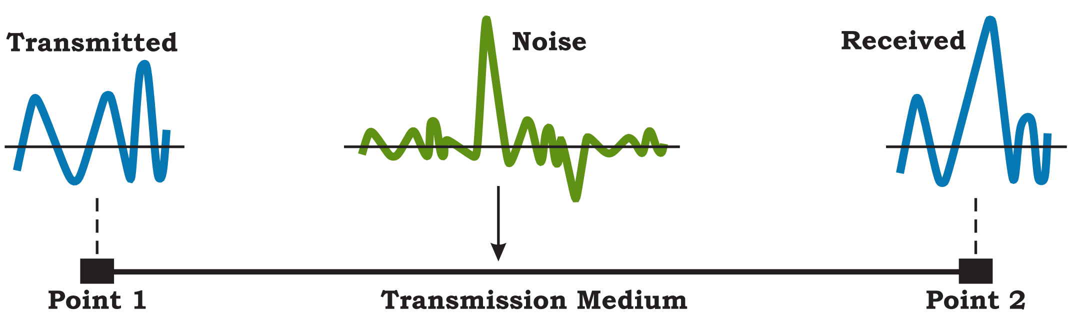


Fig: 4.14 Noise

SLOs

- Define different communication devices
- Explain the function of router
- Differentiate among different types of modems
- Describe the function of switch/router
- Elaborate the functions of different communication devices

4.3 COMMUNICATION DEVICES

A communication device is any type of hardware capable of transmitting and receiving data, instructions and information.

4.3.1 Switch

A switch or network switch (Figure 4.15) is a networking device that connects computers and other devices like printers, scanners and cameras on a network. Data cables from all computers and other devices of network are plugged into the switch to enable communication between them.



Fig: 4.15 Switch

4.3.2 Router

A Router (Figure 4.16) is a device that connects two or more networks. Routers are a combination of hardware and software. The main function of a router is to determine the optimal data path and transfer the information through that path, also known as network traffic controller.



Fig: 4.16 Router

4.3.3 Modem

Modem is short for Modulator and Demodulator. Modulation is the process of converting digital signals into analog signals. Demodulation is

quite opposite; it converts analog signals into digital signals. Modem has the ability of sending and receiving signals that allows computers to share information with each other. This sharing of information is possible over phone lines, cables or satellite connections.

(i) Dial-up Modem

Dialup modems (Figure 4.17) use standard telephone lines to transmit and receive information. A dialup modem can be internal or external. It is important to remember that telephone lines carry only analog signals, whereas data packets sent by the computer are in digital form. In order to send these packets across a telephone line, modem converts digital signals into analog.



Fig: 4.17 Dial-up Modem

(ii) DSL Modem

DSL stands for Digital Subscriber Line (Figure 4.18). Like dial-up modem DSL modem also uses telephone lines to transfer digital signals. DSL modem has a built-in network switch which enables use of twisted pair wires to deliver data and voice at high speed as compare to dial-up modem. Some DSL modems also have wireless communication functionality.



Fig: 4.18 DSL Modem

(iii) ISDN Modem

Integrated Services Digital Network (ISDN: Figure 4.19) is a digital phone connection that can transmit data, voice and video over a normal telephone line at the same time which was not done before. It is faster and expensive technology. Since ISDN work on digital transmission it converts analog voice to digital signals before transmission.

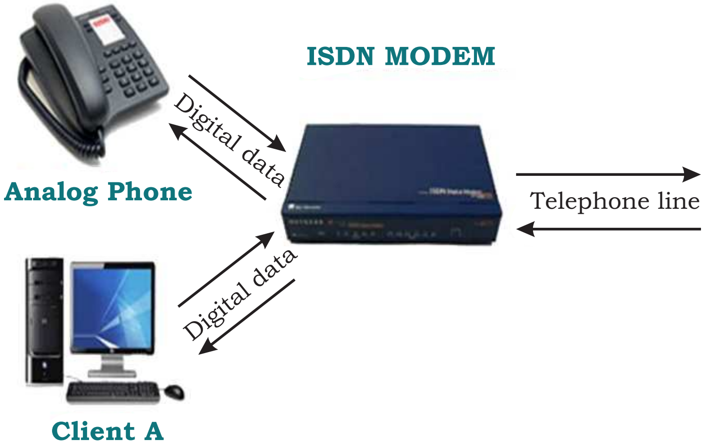


Fig: 4.19 ISDN Modem

4.3.4 Network Interface Card (NIC)

Network cards also known as Network Interface Cards (NICs: Figure 4.20) are hardware devices that connect a computer with the network. They are installed on the mother board. They are responsible for establishing a physical connection between the network and the computer. Computer data is translated into electrical signals and sent to the network via Network Interface Cards. Modern motherboards have built-in NICs.

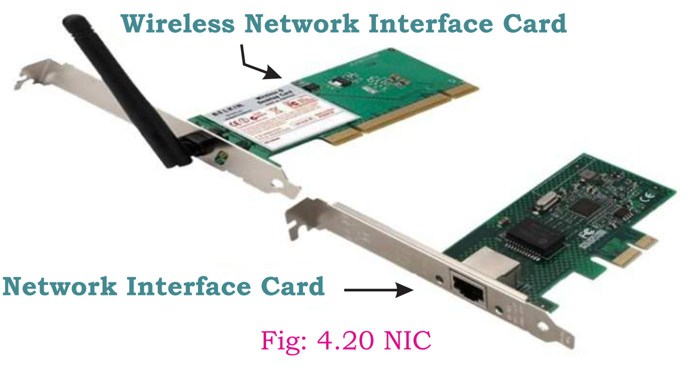


Fig: 4.20 NIC

SLOs

- Define the term computer network and networking
- Classify the network types on the basis of their characteristics

4.4 BASICS OF COMPUTER NETWORKS

Computer networks are just like a highway on which data can travel. A computer network connects parts of distributed system including hardware and software. It shares common functions and features like data and devices which is very important nowadays.

4.4.1 Computer Network and Networking

(i) Computer Network

A computer network is a group of computers and related equipment connected by a communication links to share data and other resources. The related equipment may be printer, scanners, fax machines, server, etc. The resources may include a file server, internet connection, etc.

(ii) Networking

Networking is the act of joining computers and its accessories so that exchange of information and sharing of resources take place. In today's world, networking plays a vital role in computers and telecommunication fields. Modern organizations create a networking environment and device connectivity for fast, inexpensive and reliable communication.

Teacher Note

Teachers are expected to show network physically. They are also supposed to show how we can access other computers and printers attached with a network.

4.4.2 Types of Computer Networks

Computer networks can be categorized by their size as well as their purpose. The size of a network can be expressed by the geographical area they occupy and the number of computers that are part of the network. Networks can cover anything from a handful of devices within a single room to millions of devices spread across the entire globe. There are three types of computer networks:

- Local Area Network (LAN)
- Metropolitan Area Network (MAN)
- Wide Area Network (WAN)

(i) Local Area Network (LAN)

LAN is a group of computer and peripheral devices which are connected in a limited area such as school, laboratory, home and office building. Useful resources like internet access, storage space and printers can be shared through LAN. It can be built with inexpensive hardware such as hubs, switches, network adapters and network cables. Data and software are also shared through LAN.

(ii) Metropolitan Area Network (MAN)

In MAN, computer network can spread across an entire city, college campus, or a small region. It can cover the area of several miles and may include multiple small networks or LANs. MANs offer very fast communication but they are expensive to establish. Therefore, only large business organization or universities set up MAN. It also requires security measures to prevent unauthorized access.

(iii) Wide Area Network (WAN)

A Wide Area Network is used for long distance transmission of data. WAN helps to cover a larger geographical area and connect cities, provinces or even countries. Using WAN technology, computers may be linked together in different countries using satellites, microwaves or telecommunication links. Therefore, large business, research and

educational organizations situated at longer distances use WAN. A WAN may include multiple MANs and LANS. WANs are set up with expensive devices and need some dedicated connections

SLOs

- Define the term network topology
- Develop understanding about physical layout of bus, ring and star topologies
- Differentiate the network topologies according to their design and physical layout

4.5 Fundamental of Topologies

The physical layout in which computers are connected is called topology. The topology of network describes the way computers are connected. Topology is a major design consideration for computer networking.

4.5.1 Bus Topology

As name suggests, in Bus Topology computers and other devices are connected with a single cable. The central cable is the backbone of the network and every device communicates with the other device through this bus. The advantages of Bus Topology are simplicity, low cost and easy expansion of the network. The disadvantage of the Bus Topology is that a breakdown in the bus cable brings the entire network down.

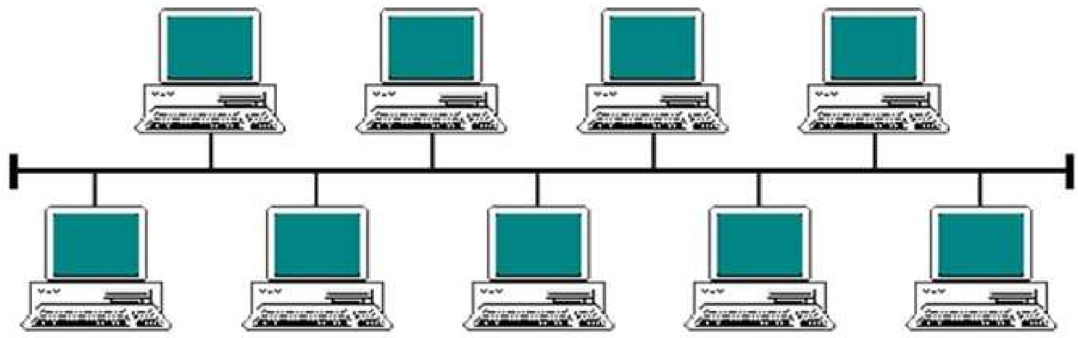


Fig: No. 4.21 Bus Topology

4.5.2 Ring Topology

In Ring Topology, computers are connected in a ring or circle shape. The signal travels around the loop in one direction and passes through each computer. The recipient of the message receives the message while another computer acts like a repeater to send it to the next computer. The failure of a link or a computer can make the entire network non-functional.

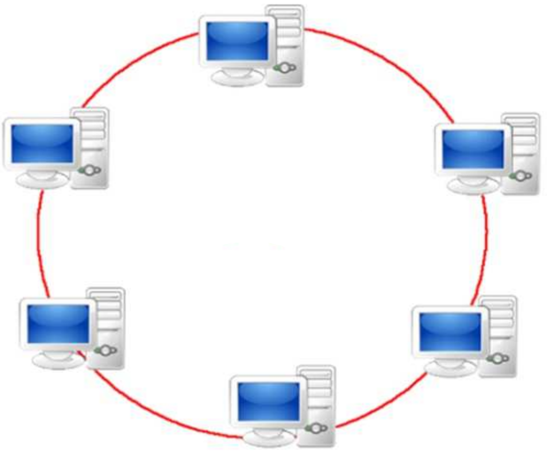


Fig: 4.22 Ring Topology

4.5.3 Star Topology

In a star topology, all the computers are connected to a central device called hub or switch. To communicate with any computer, the sender must send information to the hub. Then the hub transmits that information to the destination. The advantages of star topology are easy to set up and easy expansion of the network. Another feature of Star Topology is that if one link to the hub breaks, only the station using that link is affected not the whole network.

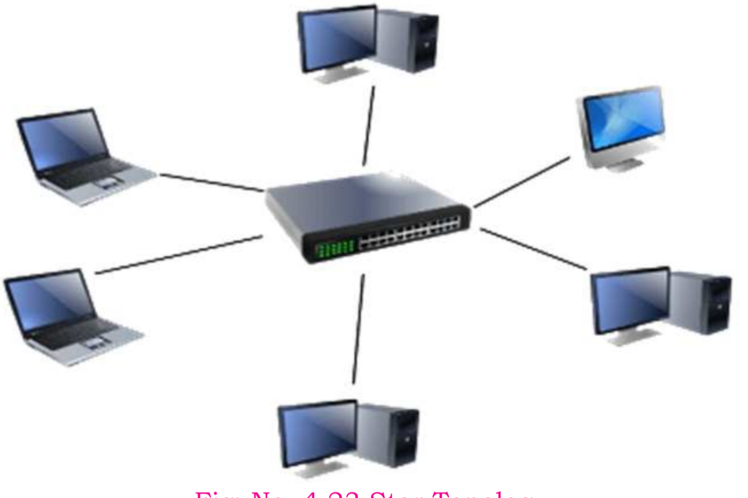


Fig: No. 4.23 Star Topology

SLO
- List out the names of standards organizations: ISO, IEEE, IETF, ITU, ANSI

4.6 STANDARD ORGANIZATIONS

Standards are rules that define the appearance, functionality, or protocols of some equipment. They are essential for network communication. Network standards define rules of communications among computing devices. This ensures that companies (i.e. Cisco and IBM) that manufacture computing and networking products follow these uniform standards. By following standards, all hardware become compatible in the network, allowing efficient networking to take place.

Standard Organization develops, coordinates, revises, amends and reissues technical standards. These standards are intended to address the requirements of a group of concerned devices. There are several organizations working on standardization of computing equipment to enable the interoperability among different devices manufactured by different companies in different regions. IEEE, IETF, ITU and ANSI are the examples of standard organizations.

4.6.1 International Organization for Standardization (ISO)

It covers a wide range of fields. The ISO has members from the standards committees of various governments across the world. It is even responsible for developing models which provides high level of system compatibility, quality enhancement, improved productivity and reduction in costs. The ISO is also responsible for endorsing and coordinating the functions of the other standards organizations.

4.6.2 Institute of Electrical and Electronic Engineering (IEEE)

It is an international professional non-profit organization. Electronics, computer and communication engineers, researchers, scientists and students are the members of IEEE. This organization develops communication and information processing standards for all fields related to electrical and computer engineering.

4.6.3 International Engineering Task Force (IETF)

It is a large international community of network designers, operators, vendors and researchers concerned with the development of internet architecture and smooth operation of the internet.

4.6.4 International Telecommunication Union (ITU)

This organization is a specialized agency that is responsible for resolving the issues that concern with information and communication technologies.

4.6.5 American National Standards Institute (ANSI)

It is the official standards agency for the United States. ANSI is a completely private, non-profit organization comprised of equipment manufacturers and users of data processing equipment and services. It supervises standards for products, services, processes, systems and personnel in the United States. ANSI membership is comprised of people from professional societies, industry associations, governmental and regulatory bodies, and consumer goods.

SLOs

- Define network architecture
- Memorize the names of seven layers of OSI's ISO model
- Define the functions of all layers of OSI's ISO model
- Describe functions of layers in TCP/IP model

4.7 NETWORK ARCHITECTURE

It is the design of a computer network. It is a framework for the specification of a network's physical components, their functional organization and configuration, operational procedures and communication protocols used. Just like OSI / TCP layered architecture.

4.7.1 ISO's OSI Model

The Open Systems Interconnection model is a conceptual model developed by ISO. It characterizes and standardizes the communication functions of a telecommunication and computing network. Its goal is the interoperability of different communication systems with standard

communication protocols. This model divides a communication system into seven abstraction layers.

No.	Layers	Functions
7.	Application	This layer enables users to access the network with applications such as email, file transfer, etc. These applications produce the data, which is transferred over the network.
6.	Presentation	It receives information from the application layer and converts it to uniform network format (ASCII or Unicode) which is acceptable by rest of OSI model and destination. Encryption and decryption are also the responsibility of this layer. This layer also reduces number of transfer bits by compression.
5.	Session	This layer establishes, maintains and ends a session or logical connection between applications on two computers. It manages who can transmit data at a certain time and for how long. This layer adds checkpoints. If session fails only data after the most recent checkpoint need to be transmitted.
4.	Transport	It ensures the reliable transmission of data. Transport layer manages error control, flow control and quality of the service. If the data is not properly transmitted it requests to resend.
3.	Network	The function of this layer is the selection of the shortest and suitable path from source to destination, from the number of routes available. It is also responsible to convert logical address (IP address) to physical address (MAC address).
2.	Data link	This layer is responsible to transmit data using physical addresses. Data Link Layer ensures error free transmission of packets. Packet in this layer is referred as Frame.
1.	Physical	It is responsible for converting electrical signals into bits. It also defines the cable types to be used as transmission media, cards, topology and other physical aspects.

4.7.2 TCP/IP Model

TCP/ IP is a suite of communication protocols used to interconnect network devices on the internet. These are set of rules and procedures. TCP/IP specifies how data is exchanged over the internet by providing end-to-end communications. It also identifies how data should be broken into packets, addressed, transmitted, routed and received at the destination. With reference to OSI layers, we can understand the functions of TCP/IP layers.

OSI Layers	TCP/IP Layers	Function
Application Presentation Session	**Application Layer**	Using protocols like HTTP and FTP, this layer allows interaction with applications. Application layer is also responsible to encode and decode data and establish communication between two devices.
Transport	**Transport Layer**	Using protocols like UDP and TCP, this layer establishes a logical connection between two devices and makes sure the reliable delivery of data.
Network	**Internet Layer**	It is responsible for packet forwarding by accessing physical path.
Data link Physical	**Network Access Layer**	Using the logical addressing this layer decides how data will be sent across different networks paths.

SLOs

- Define network address
- Differentiate between Physical Address and Logical Address
- Describe IPV4 address

4.8 NETWORK ADDRESSING

Network addresses are like our house addresses. They must be unique and distinctive. This avoids confusion for the postman. A network address is any Logical or Physical Address that uniquely identifies it from

others. This address is needed to distinguish a network node or device on a computer network. It is a numeric or symbolic number or address that is assigned to any device that seeks access to network or is the part of a network. Remember, Physical and Logical Address are different.

Difference between Physical Address and Logical Address:

Physical Address	Logical Address
1. Physical address is attached with ROM of the NIC card.	1. Logical address is assigned to a device.
2. Physical Addressing means MAC (Media Access Control) provided by manufacture and attached address of the NIC. The card which is used to connect your machine to the internet.	2. Logical addressing means IP addressing that is provided by your Internet Service Provider (ISP) or set by network administrator.
3. Physical addressing cannot be changed. They are also called hardware address.	3. Logical Address can be changed.
4. Physical address is a 48 bit mac address.	4. Logical address is a 32 bit IP Address.
5. It is globally Unique and permanent.	5. It is unique in one network and temporary.

4.8.1 IPV4 Address

An IP address is a unique number or address used to identify a device on a network. The device could be a computer, printer, smart phone, tablet, etc.

Every device connected to the internet must have an IP address to communicate with other devices. IP address acts as a telephone number or a car registration number. It shows ownership and location. IP address allows a device to communicate and be located by other devices on the internet. IPV4 stands for Internet Protocol version 4.

An IPV4 address is made up of 32 binary bits, which is divided into two parts, network and host. The network portion of the address mentions

the computer network and the host portion identifies the computer or any other computing device. IP version 4 (IPV4) addresses are comprised of four number segments separated by dots. Example of an IP address is 192.168.108.105.

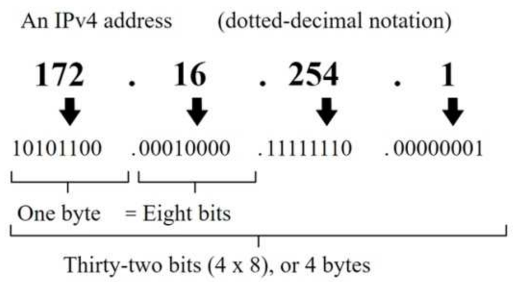


Fig: 4.24 IP Address

SUMMARY

- Communication is the process of sharing a message. Data communication refers to the exchange of digital messages between two devices.
- Analog signals are continuously varying signals or waves that change with time period and used to represent data.
- A digital signal is an electrical signal that is converted into a pattern of bits to represent a sequence of discrete value.
- Data rate refers to the rate at which data is transferred. It is normally measured in bits per second transferred.
- The baud rate is the number of signals transmitted per second and one signal can represent one or more bits.
- A communication system has following five component; message, sender, receiver, medium, protocol.
- The effectiveness of a data communications system depends on the fundamental characteristics which include delivery, accuracy and timeliness.
- Transmission medium or communication channel is a wireless or physical path between the sender and receiver through which data is sent and received from one place to another.
- Transmission media is broadly classified into two groups guided and unguided.

- Twisted Pair Cable is made by putting two separate wires together in a twisted pattern.
- Shielded Twisted Pair (STP) is type of cable consists of a special jacket to block external interference.
- Coaxial cable has an outer plastic covering containing two parallel conductors each having a separate insulated protection cover.
- In fiber optic cable data is transferred in the form of light.
- Radio waves are also called electromagnetic waves.
- Radios, television and cordless phones use radio waves for transmission.
- Microwave transmission is a line of sight transmission i.e. the sending and receiving antennas need to be properly aligned with each other.
- Infrared light is transmitted generally line of sight (point to point).
- Transmission impairments are those defects that occur when data is transmitted. There are three kinds of impairment as attenuation, distortion and noise.
- Attenuation means loss of energy or a weakened signal.
- Distortion means change in the shape of the signal.
- Influence signal that mixes up with the original signal during the transmission of data is called noise.
- A switch or network switch is a networking device that connects computers and other devices like printers, scanners, and cameras of a computer network.
- A Router is device that connects two or more networks.
- Dialup modems use standard telephone lines to transmit and receive information.
- DSL stands for Digital Subscriber Line. DSL modems are the next step in modem technology.
- Integrated Services Digital Network (ISDN) is a digital phone connection that can transmit data, voice and video over a normal telephone line at the same time.
- Network cards also known as Network Interface Cards (NICs) are hardware devices that connect a computer with the network.
- A computer network is a system of computers and related equipment connected by a communication links to share data and other resources.

- Computer networks can be categorized by their size as well as their purpose.
- There are three types of computer networks Local Area Network (LAN), Metropolitan Area Network (MAN) and Wide Area Network (WAN).
- A Local Area Network (LAN) is a group of computer and peripheral devices which are connected in a limited area such as school, laboratory, home, and office building.
- A Metropolitan Area Network or MAN consists of a computer network across an entire city, college campus, or a small region.
- A Wide Area Network is used for long distance transmission of data. WAN helps to cover a larger geographical area. It may connect two or more countries.
- Bus topology consists of a single cable by which all the computers and other devices of a network are connected.
- In ring topology, computers are connected in a ring shape.
- In a star topology, all the computers are connected to a central device called hub or switch.
- Network standards define rules of communications among computing devices.
- International Organization for Standardization (ISO) consists of members from the standards committees of various governments across the world.
- IEEE, IETF, ITU and ANSI are examples of standard organizations with different goals and functions.
- Network architecture is the design of a computer network.
- The OSI is a conceptual model that characterizes and standardizes the communication functions of telecommunication and computing.
- A network address is any logical or physical address that uniquely identifies itself from other addresses.
- Physical address is a 48 bit MAC, permanent address.
- Logical address is a 32 bit IP Address. It is temporary.
- An IPV4 address is made up of 32 binary bits, which is divided into two parts, network and host.

EXERCISE

A. Choose the right answer:

1. Wired Media is also called:
   a) targeted media b) directed media
   c) guided media d) unguided media

2. Communication system is made up of
   a) three components b) four components
   c) five components d) six components

3. Both Physical and Logical addresses are:
   a) different b) unique
   c) permanent d) temporary

4. If you are an electrical or electronic engineer, you should join:
   a) IEEE b) IETF
   c) ITU d) ANSI

5. The topology in which all computers are connected to a central device called hub is:
   a) Bus b) Star
   c) Ring d) Tree

6. Change in the shape of signal between sender and receiver is called:
   a) attenuation b) interruption
   c) noise d) distortion

7. Router determines data path to transfer data packets which is the:
   a) shortest b) longest
   c) cheapest d) optimal

8. Converting digital signal to analog is called:

a) modulation b) modification

c) bandwidth d) multiplexing

9. The number of bits used in an IPV 4 address are:

a) 16 b) 32

c) 64 d) 128

10. The loss of energy in transmission signal refers to.

a) Attenuation b) Distortion

c) Noise d) Jitter

B. Respond the following:

1. List the properties of a good communication system. Explain any one.
2. Explain components of communication using single example.
3. Write the function of following network devices.
   Amplifiers, Routers, Switch, Hub
4. List the causes of signal impairments. Explain any one.
5. What is the difference between radio wave and microwave?
6. Why OSI model is broken up in layers?
7. Explain the purpose of Standard Organization.
8. List one merit and one demerit of each topology.
9. Give one example of LAN, WAN and MAN.
10. How can we measure bit rate and baud rate? Give an example of each.

C. Match the columns:

S.NO.	A	S.NO.	B	C
(i)	Parts of an IPV4 address	(a)	WAN	
(ii)	Physical address	(b)	Network and Host	
(iii)	Change in shape of signals	(c)	Transport layer	
(iv)	A networking connecting two continents	(d)	Data link layer	
(v)	TCP and UDP are used at	(e)	Cannot be changed	
(vi)	In OSI model the layer responsible to decide the format of data	(f)	Distortion	

ACTIVITIES

1. APSTNDP are the first characters of OSI Model's Layer. Make sentence of seven words where each word starts with each character.
2. Compare Coaxial Cable, UTP, STP and Fiber Optic cable in terms of cost, data rate, installation, interference and maximum length of segment.
3. Uncover the twisted pair cable, count number of wires and also make list of color scheme.
4. Identify different type of layers of coaxial cable.
5. Identify and write names of different connectors used in telephone landline, coaxial cable and twisted pair cable.
6. Make a list of hardware equipment for each topology.
7. Draw a Hybrid Topology diagram in which bus, ring and star topologies are used.

COMPUTER SECURITY AND ETHICS

Unit 5



SLOs

- Explain the importance of computer security in daily life
- Define various terms related to computer security
- Explain computer crimes by giving real-life examples
- Describe Cyber-Attacks and how to prevent them
- Discuss Cyber- Harassment and what to do in case of becoming a victim
- Explain how to seek help against Cyber-Crime

5.1 COMPUTER SECURITY

The computer has become an important part of our life. We store important data on our computers in the shape of documents, pictures, programs, etc. Therefore, we expect that all our information must remain safe and our computer runs properly without any problem. Few threats can cause problems for our computers. These threats may be different types of viruses or unauthorized use of a computer. To prevent our computer from such threats, we need to abide by computer security. Computer security is the protection against theft or damage to our computer hardware, software and information present on it.

5.1.1 Importance of Computer Security

Computer security is important for our computer's overall health. It keeps our information protected and helps prevent viruses and malware, which allows programs to run quicker and smoother. It safeguards confidential and sensitive information.

The advancement in science and technology has changed the ways we live and carry out day to day activities. We rely on computers and mobile phones to carry out many activities. While using computers and mobile phones we access a lot of information which we do not want to share with others. This information may include our passwords, banking details, contacts, pictures, etc. To protect this information we need to make our devices secured that no one can damage or access this information without our consent.

Computer Security is important as it enables people to perform their work in safe environments. It helps in the execution of essential business processes. Here are a few reasons why computer security should be taken seriously.

5.1.2 Cybercrime:

As communication, trade, and services are relying more on computers and networks, the cybercrimes are growing too. Cybercrime is the crime that is committed through a computer and network. Cybercriminal uses devices to gain unauthorized access to important information. Stealing passwords and important information, hacking social media accounts, accessing anyone else's account and making transactions, committing online frauds are some of the examples of cybercrime. Cybercrime is illegal and also punishable. According to Pakistan's Cybercrime Law, any offender who interrupts the privacy of a person or organization and harms their repute may be sent to jail for three to five years including a heavy fine.

(i) Hackers:

Hacker can be a person who has in-depth knowledge of computer systems, networks, and programs. Hacker maybe someone who uses his or her extensive skills to identify and overcome a network loophole. Hackers constantly seek further knowledge and freely share what they have discovered. Hackers are generally considered as bad people however, hackers can also help us to improve the data and network security. Government and business organizations are now hiring ethical hackers, also known as white hat hackers, to prevent data theft.

(ii) Crackers

Crackers are persons who gain unauthorized access to another system. They bypass passwords or licenses of computer programs, change source code or intentionally breach computer security. They do it with negative intentions. Crackers can also make targeted system unavailable or non-functional. They commit these activities generally for money but they may do it for fame or just for challenge or fun.

5.1.3 Computer Crime in Real Life

As technology is growing the data security has become so crucial. We can be a victim of computer crime at any time. Computer crime can range from an international data security threat to a personal offense. In 2013, hackers managed to hack 1 billion email accounts of the users. Likewise, in 2017, the WannaCry virus attacked the National Health Service in the United Kingdom which made the whole system non-functional for several days. As far as personal offenses are concerned, hacking the social media and mail accounts are so common. There are many genres of computer crime or now called cyber-crimes. Some examples of such crimes in real life are discussed here.

(i) Hacking

Hacking is perhaps the most common crime in the computer world. Hackers can steal our WiFi, email or social media accounts' passwords. Hackers also attack a website and take it down. However, the scope of hacking is much wider. The hackers can also steal sensitive information from government and business organizations, make fraudulent transactions and erase data on the cloud or network computers.

(ii) Credit and Debit Card Scam

Keeping debit or credit cards is a common practice but insecure use of these cards can be dangerous. If a person has information about our debit or credit card he or she can make fraudulent transactions. There are various ways to get this information. One way is through scamming. Scammers set small machines inside an ATM or credit card machine. These machines copy the data which is then misused by the scammers. Debit and credit cards are also secured with PIN codes. User has to keep this code secret otherwise any person can use the card for online shopping and other purposes. All he or she needs to know our credit card number, PIN and security code printed on the back of the cards.

(iii) Phishing

Phishing is a method of trying to gather personal information using false e-mails and websites. In Phishing, perpetrators contact the target

person through email, telephone or text message and pose as a legitimate and trusted individual. He or she asks the target to provide sensitive data such as personally identifiable information, banking and credit card details and passwords for different reasons. The information is then used to access different accounts and can result in identity theft and financial loss.

(iv) Clickjacking

Have you ever seen any video tagged as “OMG? You won't believe what this boy has done!” or did you find a button on a website that asked to click to claim a reward you had never applied for? This is a kind of fraud which is called Clickjacking. Usually, culprits target children or novice internet users to click on a link containing malware or trick them into sharing private information via social media sites.

(v) Cyber Bullying or Harassment

Electronic means like a computer, mobile phone or internet are also used for online bullying or harassment. Harmful bullying behavior can include posting rumors, threats, passing inappropriate remarks, leaking personal information, blackmailing and committing hate speech. The perpetrator does it with the intent to cause harm to the victim. Victims may experience lower self-esteem, intent to commit suicide and a variety of negative emotional responses, including being scared, frustrated, angry and depressed.

5.1.4 Cyber Attack

Cyber-attacks occur when a cybercriminal uses computer or any device to launch attacks to other single or multiple computer networks. The culprit tries to enter in a computer system and network through cracking, scam links, phishing or any other method. Generally cyber-attacks are committed for getting any benefit or causing harm to victim computer, network or websites. A cyber-attack either disables the targeted computer, deletes information or knocks it offline. It may also steal information from the computer or network.

5.1.4 What to do? In Case of Becoming a Victim

The perpetrator of cyber crime always asks to keep his or her contact secret otherwise the victim may face heavy loss. The response of the victim of cyber crime, bullying or harassment is very crucial. There are ways to get rid of such miseries. First thing is to report such incidents to the trusted people that are highly likely parents and teachers.

Fig: 5.1 Cyber Rescue Helpline

The government has also taken measures to curb cybercrimes especially cyber bullying and harassment. In Pakistan, the National Response Centre for Cyber Crimes has been set up to help the victims of cybercrimes. An online complaint can be launched through the form available on the website or help may be sought by calling helpline 9911 which is available 24/7.

SLOs

- Define computer virus and how to prevent them
- Define and differentiate various types of viruses: Malware , Virus, Worm, Adware and Spyware
- Identify that a virus, worm, adware, spyware and Malware can spread through different ways
- Recognize that the antivirus software like Avast, Norton, MacAfee and others can help to safeguard against viruses

5.2 MALWARE

The term malware is the contraction of malicious software. Malware is a broad term that encompasses computer viruses, worms, spyware, adware and others. Malware is a program that is written generally to cause a mess. They can be so dangerous that they can also damage devices. However commonly malware encrypt, steal or delete data, hijack core functions of computing and disturb different activities.

5.2.1 Different Malware

Types of malware can include computer viruses, worms, adware, and spyware.

(i) Computer Virus

A computer virus is a computer program that can spread across computers and networks by making copies of itself, usually without the user's knowledge. It can also modify other computer programs, insert its own code and change computer settings. Viruses are harmful. They can range from displaying irritating messages to make all the documents inaccessible or even delete them. Viruses generally latch on a host file and when they execute they infect other files or programs. Boot Sector, Resident, Macro Viruses and File Infector are some examples of viruses.

(ii) Worm

A computer worm spreads copies of itself from computer to computer. A worm can replicate itself without any human interaction. It does not need to attach itself to a file or program to cause damage. It can do several malicious tasks, such as dropping other malware, copying itself onto devices physically attached to the affected system, deleting files, and consuming internal storage and memory resources.

(iii) Adware

Adware is advertising-supported software. They present endless ads and pop-up windows that could potentially consume memory and processing resources. Adware can also change the different settings of internet browsers like homepage and default search engine. Normally, these are not as dangerous as other malware. However, Adware annoys the user and slows down the processing. The advertisements produced by adware are sometimes in the form of a pop-up or sometimes in little windows that may not be closed. Adware programs include games, desktop toolbars or utilities. Commonly, adware is web-based and collects web browser data to target advertisements, especially pop-ups.

(iv) Spyware

Spyware is a malware that monitors a device and steals important information about a person or organization without their consent and sends such information to another person or organization. Spyware takes control over a mobile phone or computer without the user's knowledge. They capture information like web browsing history, e-mail messages, usernames and passwords and online payment information. Spyware can come through cookies or even when we install software without reading its terms and conditions. System monitors, cookies trackers, rootkits and key-loggers are few examples of Spyware.

5.2.2 Ways of viruses spread

A computer virus is just like a flu virus. It is designed to spread from one device to another device and can replicate itself. Any device that is infected from a virus can infect other devices. It means that viruses come from outside. How do they come? Here are some ways:

(i) USB Flash Disk and CDs

USB Flash Disks are the most common media to transfer files. An infected computer can spread a virus to a clean USB flash disk that is inserted and likewise, an infected USB can transmit the virus onto a clean computer. The AutoRun function in Windows OS launches installers and other programs automatically when a flash drive or CD is inserted. This action can initiate a virus spreading process onto the computer. Copying infected files from the USB or CD can also infect the computer.

Teacher Note

Teacher should provide the information of viruses like Trojan horses, Rootkit, Backdoors, and Bots. This may be given as an assignment.

(ii) Internet Downloads

Computer viruses also spread through files or software downloads from the Internet. They can be attached to software or files that we download. The viruses come from the internet can also make our computer accessible to hackers. Though, almost every antivirus software provides a shield against malicious downloads,it is highly recommended that the software and files must be downloaded from trusted sources.

(iii) Computer Network

Users must be careful because files picked from a Local Area Network (LAN) may be infected and cause damage to our computer or operating system. The same can happen to transfer files from one mobile device to another mobile device via Bluetooth etc.

(iv) Email Attachments

Email attachments have been a popular medium to spread viruses. Viruses can easily be transferred from one computer to another through email attachments. The infected emails may come from an unknown or fake email address. Perpetrators who spread these viruses use either fake email or change a few letters in a trusted email address. People in our contact list may also send us infected files as they may not be aware of it themselves. Users must check the origin of the email before opening the attached files or clicking any link that is given in the email. Especially spam mails must be checked carefully before clicking on its attachment.



Fig: 5.2 Viruses can spread through emails

5.2.3 Antivirus

Antiviruses are utility software designed to protect computers from any potential threats of data or hardware loss. It is highly recommended that the user must install an antivirus on an operating system like

Windows. Antivirus software works in the background and monitors every software that is running and the emails or data coming from the internet. In case of any suspicious activity, antivirus alerts the user and asks for action. Normally, antivirus tries to clean the files and if not succeeded it quarantines the infected file. This is highly recommended that the user should update the antivirus regularly. Many antivirus software can be found on the internet and most of them are generally free. However, in the free version of antivirus, some advanced features are not available. Paid customers are called premier users and they get advance security features.

The most common antiviruses are:

(i) Avast

Avast is one of the largest security companies in the world. Avast's management claims that they are using next-gen technologies to fight cyber-attacks in real-time. They also claim that Avast has an immense cloud-based machine learning engine that receives a constant stream of data from hundreds of millions of users. This facilitates learning at extraordinary speeds and makes artificial intelligence engine smarter and faster to stop viruses.

Fig: 5.3 Avast Antivirus

(ii) Norton

Norton antivirus has been a popular antivirus utility since 1991. This is a part of a large family of security and other utility software by Symantec Corporation. Norton Antivirus is easy to use, has the configuration options that experts need, comes highly rated by the testing labs and is exactly designed to have the least possible impact on your system performance.

Fig: 5.4 Norton Antivirus

(iii) McAfee

McAfee claims that it provides a combination of antivirus, privacy and identity tools and features. This enables users to stay protected against the latest virus, malware, ransomware and spyware attacks while keeping their identity and privacy protected and personal.

Fig: 5.5 McAfee Antivirus

5.2.4 Safeguard against Malware

Keeping ourselves safe from malware and viruses is mostly in our hands. More than 90% of computers are infected due to the user's mistake. Our computers have caught a virus if they start slowing down, behave unusually, crash during processes or restart several times, show annoying messages and some of our documents disappear or become inaccessible. We must avoid this situation to be created. Some simple measures can prevent our system from malware and viruses.



Fig: 5.6 Schedule scan can safe from data loss

- Install anti-virus software and keep it updated.
- Run scheduled scans regularly with your anti-virus software.
- Keep your operating system updated.
- Do not click on internet links which have unusual labels, images or captions.
- Do not open email attachments or click on hyperlinks from unknown senders.
- Scan USB flash drive, SD cards and mobile phones before opening.
- Use your spam blocking or filtering tools to block unsolicited emails, instant messages and pop-ups.
- Only download files and programs from trusted sources on the internet.
- Never use an open WiFi.

5.2.5 Keeping the Backup of Data

Besides this, we should also take some measures to recover data from any potential loss. Some steps in this regard are:

- Create a system restore point regularly and check if it is not disabled.
- Write important data on CDs or DVDs. Since they are write-protected, they do not catch viruses.
- Have the back-up of important files at more than one place.
- You can also save documents on cloud storage like Google Drive and Microsoft OneDrive.

SLOs

- Describe the authentication mechanism
- List out the different authentication mechanisms
- Differentiate between username and password, personal identification number and biometric authentication mechanisms

5.3 AUHENTICATION MECHANISM

The authentication mechanism is the hardware or software-based mechanism that forces users to prove their identity before accessing data on a device. The process makes sure the only authenticated user gets access to data or devices.

5.3.1 Types of Security Mechanism

There are many ways a computer security system may authenticate a user. Some of them are:

(i) Username and Password:

A username and password are the pair of keywords known by the user. They are presented to the computer to authenticate the user. Usernames and passwords are the default authentication mechanism on

the web today. However, recent large scale computer attacks have made usernames and passwords an unacceptable authentication mechanism. Additional authentication mechanisms are needed to fully authenticate.

(ii) Personal Identification Number

PIN stands for Personal Identification Number. It is a security code for verifying your identity. Similar to a password, your PIN should be kept secret because it allows access to important services such as financial transactions and confidential emails. The PIN provides security when a credit/debit card is lost or stolen because the PIN must be known before making money withdrawal or transfer.



Fig: 5.7 PIN Identification

(iii) Biometric Verification

Unlike authentication processes, biometrics verification makes sure that the real person gets access to the data or device. Biometric authentication relies on the unique biological characteristics of a person. Biometric authentication systems captures data in real-time and compare it with existing data in database. If both samples of the biometric data match, authentication is confirmed. Scanning fingerprints are the most common way of biometric. However, some other advance ways include retinal scans and iris, facial and voice recognitions.



Fig: 5.8 Iris and thumb impression verifications

SLOs

- Explain the importance of professional ethics in computer field
- Define information accuracy
- Explain various types of intellectual property rights: Patents, Copyright and Trademarks
- Explain software piracy and its impacts
- Describe the information privacy
- Discuss plagiarism

5.4 PROFESSIONAL ETHICS IN COMPUTER FIELD

Professional ethics involve the personal and corporate principles and rules that guide behavior within the context of a profession. The role of a professional code of ethics is to clarify values and rules and can be used as a framework for discipline. Computing professionals' actions change the world. To act responsibly, they should reflect upon the wider impacts of their work, consistently supporting the public good. Here are some guiding principles:

- Contribute to society and human well-being, acknowledging that all people are stakeholders in computing.
- Be honest and trustworthy.
- Respect the equipment.
- Avoid causing any harm.
- Be fair and act not to discriminate, bully or harass.
- Respect the work required to produce new ideas, inventions, creative works, and computing artifacts.
- Respect privacy and maintain confidentiality.
- Maintain high standards of professional competence, conduct, and ethical practice.
- Create opportunities for other individuals or groups to grow as professionals.
- Manage personnel and resources to enhance the quality of work life.
- Ensure that the public good is the central concern during all professional computing work.
- Access computing and communication resources only when authorized.
- Foster public awareness and understanding of computing, related technologies and their consequences.

5.4.1 Define Information Accuracy

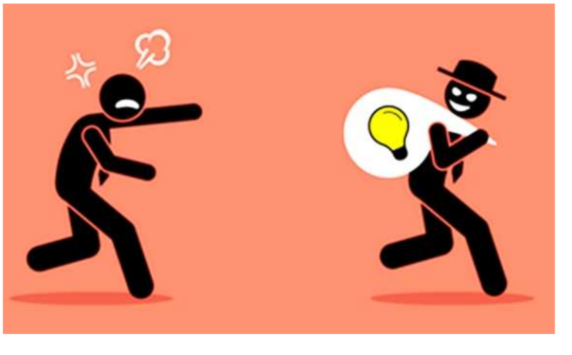
The information accuracy is the type of measurement that assures the information is correct and true. It is also necessary that the information should not be generated from the malicious data. For information accuracy, the data must be from reputable sources.


Fig: 5.9 Ensuring information Accuracy is necessary

In the era of information explosion, we need to be more careful while using or disseminating information. The use of unreliable sources results in inaccurate information. Especially, the accuracy of information shared on social media is often questionable.

5.4.2 Intellectual Property Right

When any person develops software, writes a book or research paper or invents any method or the machine, it becomes the intellectual property of that person. Intellectual property is intangible creations of the human intellect. Just like other property the intellectual property can be stolen. To prevent theft or illegal use or spread of intellectual property, Intellectual Property Right is exercised. Through these rights, intellectual property is protected with the help of copyrights, patents, and trademarks. They allow creators or owners of patents, trademarks or copyrighted works to benefit from their work or investment. Under these rights, no other person or organization can copy or reproduce any other's intellectual property. Intellectual property rights are acclaimed worldwide. In Pakistan, Intellectual Property Organization (IPO) regulates the matters regarding intellectual property rights.


Fig: 5.10 Intellectual Property should be regarded

(i) Patent

A patent is a grant of exclusive rights for an invention to make, use and sell the invention for a limited period, in Pakistan 20 years. Owning a patent gives the patent holder the right to stop someone else from making, using or selling his or her invention without permission. To protect students and scholars, the Higher Education Commission also offers support to get patents registered with Intellectual Property Organization (IPO). The patentable process or invention must be novel, possess inventive steps and can be used in industries.



Fig: 5.11 Patent

(ii) Copyright

Copyright is a legal instrument that provides legal rights to the creator of artwork, literature, or a work that conveys information or ideas. In simple words, copyright is the right of copying. Copyright gives control over how the work is used. Copyright intends to advance the progress of knowledge by giving an author of a work an economic incentive to create new works. The © sign is also often displayed on copyrighted objects.



Fig: 5.12 Copyright

(iii) Trademark

Trademark identifies a product or service and distinguishes it from other products and services. Trademarks are protected by intellectual property rights which identifies that the product or service belongs to a specific organization. It can be an easily recognizable word, phrase, logo, or symbol and often mentioned as TM (Trade Mark). Trademark helps organizations to market their products and services locally and globally. Developing trademarks is creative work and can be done professionally. There are many software available for developing Trademarks.



Fig: 5.13 Trade Marks Registry

5.4.3 Software Piracy

Software piracy is referred to the illegal use, copying or distribution of copyrighted software. Software piracy is a huge threat to the software industry. It causes a significant loss of revenue for developers and vendors. Because of piracy, vendors have fewer resources to devote to research and development of new products. Since they earn less profit, they are forced to pass these costs on to their customers.

Software companies have tried various techniques to stop software piracy but most of them have remained unsuccessful. They applied for copy- protection which demands the user to enter certain keys or credentials. Today, most software require registration which is mainly online. However, these measures could not stop software piracy.

Using pirated software is also risky for users. Aside from the legal consequences of using pirated software, users of pirated software lose some practical benefits as well. Pirated software may not work properly or stop working at any time. Furthermore, pirated software users cannot access customer support, upgrades, technical documentation, training, and bug fixes.

5.4.4 Plagiarism

Plagiarism is presenting someone else's work or ideas as your own without full acknowledgment to the author or conceiver. Academic honesty demands that the users of any ideas, words and data should acknowledge the originators. Plagiarism is unethical and can have serious consequences. Colleges and universities encourage students to submit their original work and cite the ideas and words borrowed from any other sources. Failing to this may cause serious penalties. There are online services to check and fix the plagiarism issues. Academic organizations hire the plagiarism detection service. One of the most used services is Turnitin.

SUMMARY

- Computer security is the protection against damage or theft of computer hardware, its software, and information present on them from threat of viruses or unauthorized use.
- Cybercrime is the crime that is committed through a computer and network.
- Hacker uses his or her skills to identify and overcome a network loophole.
- Crackers are persons who gain unauthorized access to another system.
- Phishing is a method of trying to gather personal information using false e-mails and websites.
- Electronic means like a computer, mobile phone or internet are also used for online bullying or harassment and giving threats.
- Cyber-attack is done when a cybercriminal uses computer or any device to enter or attacks to other single or multiple computer networks.
- Cyber-attack or cyber harassment victim should report to the trusted people and government authorities.
- The malware or malicious software is a broad term that encompasses computer viruses, worms, spyware, adware, and others that is written generally to cause a mess.
- Viruses or malware can be spread from USB Flash Disks and CDs, Internet Downloads, Computer Networks and Email Attachments.
- Antiviruses are utility software designed to protect computers from any potential threats of data or hardware loss from viruses or malware.
- For data safety, the back-up of important files should be made at more than one place.
- The authentication mechanism is the hardware or software-based mechanisms that make sure the only authenticated user gets access to data or devices.
- Professional ethics involve the personal and corporate principles and rules that guide behavior within the context of a profession.
- The information accuracy is the type of measurement that assures the information is correct and true.

- Intellectual property is intangible creations of the human intellect. To prevent theft or illegal use or spread of intellectual property, Intellectual Property Right is exercised. Through these rights, intellectual property is protected with the help of copyrights, patents, and trademarks
- Software piracy is the illegal use, copying or distribution of copyrighted software.
- Plagiarism is presenting someone else's work or ideas without full acknowledgment of the author or conceiver.

EXERCISE

A. Choose the right answer:

1. The broad term that encompasses different harmful software is:

a) Virus	b) Malware
c) Adware	d) Spyware

2. The authentication mechanism that only allows the real person to access data or device is:

a) Username and Password	b) PIN
c) Biometric	d) Scan Code

3. Software are mostly protected under:

a) Patents	b) Copyrights
c) Trademarks	d) Logos

4. The professional ethics in computer field is important because:
   a) It is necessary by law.
   b) Violation can cause serious penalties.
   c) It is useful for financial benefits.
   d) It creates healthy and positive work environment.

5. Free Antivirus Software often

a) Expire after sometimes	b) Offer only limited service
c) Cannot be updated	d) Cannot be purchased

6. Copying and pasting some texts from internet without acknowledging the real author is an example of:
   a) Plagiarism b) Illegal use of patent
   c) Information Piracy d) Copyright Violation

7. Since it does not harm or steal data, the least harmful malware is:
   a) Virus b) Adware
   c) Spyware d) Trojan

8. The malware that replicates itself and doesn't need to attach with any files is:
   a) Virus b) Adware
   c) Spyware d) Worm

9. Through which virus spreads?
   a) Email Attachments b) Internet Downloads
   c) Flash Disks and Cds d) All of them

10. "Click this link and win a $5 voucher at McDonald's". This is an example of:
   a) Scam b) Phishing
   c) Clickjacking d) Hacking

B. Respond the following:

1. Why is computer security important? Write any three reasons.
2. Explain Cyber Bullying with an example.
3. Why is information accuracy important?
4. What is Ethical Hacking?
5. Your friend has become a victim of cyber harassment. What two advices will you give him or her?
6. Write any two measures to avoid email account hacking.
7. How is software piracy harmful for software developers?
8. Give two examples of phishing.
9. What is an Intellectual Property Right?

10. Differentiate the following on the given criteria.

Criteria	Virus	Worm	Adware	Spyware
Level of danger				
How is it initiated?				
Damage that can be done to data and hardware				
Effect on computer speed				
Means to spread				

C. Match the columns:

S.NO.	A	S.NO.	B
(i)	Presenting someone's ideas as your own without acknowledging the author.	(a)	Adware
(ii)	An advertising software that presents ads & pop-up windows to spread virus.	(b)	Cracker
(iii)	Crime that is committed through a computer system.	(c)	PIN
(iv)	A secretive security code that verifies user's identity.	(d)	Antivirus
(v)	A person that gains unauthorized access to other computers by bypassing passwords.	(f)	Plagiarism
(vi)	A utility software that prevents threats and data loss from a computer.	(e)	Cybercrime

ACTIVITIES

Activity 1:

Organize a poster exhibition in which students suggest measures to the audience how to use the computer and the internet safely. Some focused topics may be:

- Prevent your computers from Viruses and Malware.
- Say no to cyber bullying and harassment.
- Say no to piracy and plagiarism.
- How to cope with cyber crimes?

Activity 2:

During classroom discussion put the following situations before students and discuss what will they do in such a situation? And why?

- You receive a phone call. The caller claims that you have won a huge prize and for delivering the prize they need an advance payment.
- You receive a file from an unknown email address which asks your bank account details or user Email ID and Password.
- While surfing an unknown website, the website demands to access content by providing your Facebook or Gmail account's credentials.

Activity 3:

Make a list of the services that free antivirus software does not offer.

Activity 4:

Search newspapers or internet to find any news about a cyber crime. Specially in which the criminal was caught and punished.

Activity 5:

Thesis and research articles are generally checked through Turnitin which is an Internet-based paid plagiarism detection service. There are other free online services where students can check the plagiarism in their document. Some are:

www.duplichecker.com
www.quetext.com
www.plagscan.com

Write an essay on any topic, and copy and paste some text from internet websites in your essay. Then check plagiarism of your document.

WEB DEVELOPMENT

Unit 6



SLOs

- Recall the understanding of basic terms related to web development
- Define different terms
- Identify and compare different types of websites
- Compare various types of websites

6.1 BASIC TERMINOLOGY OF WEB DEVELOPMENT

Development of web sites and online applications is called web development. This is done by coding in different languages and by using several web development tools and frameworks. A complete web application may consist of a User Interface, Back-End Server Codes and a Database.

6.1.1 Definition of Terms

(i) World Wide Web (WWW)

The word world wide web (www) is commonly known as the web. The Web is a collection of computers connected through a network to provide publicly accessible information.

(ii) Web Page

A webpage is a document commonly written in HTML that is accessible through internet by using internet browser.

(iii) Website

A website is a collection of web pages containing text, images, and all types of multimedia related to a specific set of information. A website can be accessed through a Uniform Resource Locator (URL).

Teacher Note

Teachers are encouraged to give additional information. For example, how web hosting is availed. How web servers work. Videos can be used to explain such concepts.

(iv) Web Browser

A web browser is a software application for accessing websites on the world wide web. Most common web browsers include Microsoft Internet Explorer, Google Chrome, Mozilla Firefox, and Safari.

v) Uniform Resource Locator (URL)

It is the address of a resource on the internet (e.g. https://www.google.com). It includes the following two components.

- The protocol used to access the resource (https://)
- The location of the server. (www.google.com)

(vi) Search Engine

A Search Engine is a web-based tool that enables a user to locate information on the web. Most popular search engines are Google, Yahoo, and Bing.

(vii) Home Page

A home page (also known as landing page) is a web page that serves as the starting point of the website.

(vii) Web Hosting

Web Hosting is a service that allows a web developer to make a website publicly accessible through the internet.

(viii) Web Server

A web server is the computer that is responsible for serving a website and all of its content including text and media to a user.

6.1.2 Types Of Website

Portal: A web portal is a website that provides a single access point of information for all of its users. It collects information from different sources like emails, forums, search engines and presents it to the user in a uniform way. Yahoo and MSN are common examples of web portal.

News: A news website is the modern-day alternative for newspapers. Such websites contain everyday information related to current affairs, sports, politics, weather, health, technology, entertainment, etc.

Informational: Informational websites provide detailed information of any field. There are many dedicated informational websites for science, arts, sports, online trainings, research, etc.

Educational: Educational websites are purely designed to deliver educational material for both, teachers and students such as sabaq.pk, khan academy.org, etc.

Personal: A person can share about his or her biography or achievements in a custom developed website.

Business: A business website is the best way for any organization to market their products and services. It also tells about the teams, policies and procedures of that business. For instance, www.psx.com.pk is the website of Pakistan Stock Exchange.

Blogs: A blog is a special type of website that is composed of articles and posts. These articles are organized into categories and sorted by the time when they were published. Wordpress is a popular blog site.

Forums: A forum is an online place where different users can discuss about any topic. These topics can be categorized so that users can easily locate topics of their interest.

Entertainment: An entertainment website serves content like videos or games purely for the purpose of entertainment. Youtube is widely used for entertainment.

Social: Social website is a platform where different people get together and socialize with each other. They can also share their ideas, opinions and media. Facebook and Twitter are instances of social networking websites.

Teacher Note

Teachers should demonstrate several websites to familiarize students with different types of websites.

SLOs

- Develop the understanding about HTML
- Apply the various steps involved in creating a web page
- Develop understanding about HTML tags
- Recognize the basic structure of an HTML document

6.2 INTRODUCTION TO HTML

HTML stands for Hypertext Markup Language. HTML is used to create web pages that are displayed by web browsers mainly on internet.

6.2.1 Hypertext Markup Language (HTML)

It is standard markup language for text documents. It allows the user to create structured content by adding headings, paragraphs, links, blockquotes and other media. It takes advantage of simple code structures called tags and attributes to achieve formatting, graphic and navigation effects on web pages.

6.2.2 Steps Involved In Creating Web Page In HTML

Creating a simple web page using HTML is very easy. It requires a text editor, a file with .html extension and a web browser to view that page.

Step 1: Text Editor

Start by simply creating a new blank file in a text editor of your choice. A simple text editor like notepad can be used to start coding HTML for a web page.

Step 2: Write HTML code in Text Editor

Example:

```
<html>
    <head>
        <title>My Website</title>
    </head>
    <body>
        Welcome to my first  web page.
    </body>
</html>
```

Step 3: Save HTML Page

Go to File menu and click on Save. Make sure to provide .htm or .html extension for the file being saved. This will save the document as a web page instead of a plain text file.

Step 4: View HTML Page in Browser

Open the saved HTML file in your default web browser. The web browser will automatically translate HTML codes to correctly display the web page.



6.2.3 HTML Tags

HTML elements are the building blocks of HTML pages. These elements are defined by placing HTML tags in our document. These tags are placed inside angular brackets (<>). Some tags also allow further customization by adding attributes to them. An HTML tag has the following structure:

Simple Tag: <tag-name>content</tag-name>

Tag with Attribute: <tag-name attribute-name= “attribute value”>content</tag-name>

The above syntaxes show the structure of opening a tag, defining attribute values, placing content inside the element represented by that tag and its closing structure. Most of HTML tags always require a closing tag while some HTML tags such as
 are empty tags which means that they don't require a closing tag.

SLOs

- Use Title and Footer tags for inserting title and footer in a web page
- Compose a paragraph in a webpage
- Use line break for starting the text from new line
- Use different text formatting tags like bold, italic, underline, etc.
- Apply Pre-tag for preserving both spaces and line breaks
- Change text color, face
- Align the portion of text in center of web page
- Write subscript and superscript text in a web page

6.3 DESIGNING AND FORMATTING

Some HTML tags introduce content directly into the web page while others enhance the design and format of that content. Some most commonly used HTML tags which change the looks of the web page are explained here.

Tag	Description
`<!DOCTYPE html>`	It specifies the HTML version used so the web browsers can show the web page according to HTML standards. All HTML documents must start with this tag.
`<html>`	All HTML documents start with `<html>` tag and end with `</html>` tag.
`<head>`	It is used to define additional information about the web page. It contains a set of tags such as `<title>`, `<meta>` , `<style>`,`<script>`, etc.
`<body>`	The main content of the web page is contained between `<body>` and `</body>` .

6.3.1 Titles and Footers

Tag	Description
`<title>`	It defines the title of a web page. Titles are very important as they appear on top of the browser window and displayed on search engine result pages.
`<footer>`	It defines the footer for a web page. e.g. “Copyright 2020. All rights reserved.”

6.3.2 Paragraphs and Line Breaks

Tag	Description
<p>	It defines a paragraph of text in a webpage. It always starts from a new line and adds space before and after its text.
 	It defines a line break and starts the following content from a new line. Unlike <p> tag, it does not add space before or after the break.
<hr>	It draws a horizontal line where it is defined. It is used to differentiate between sections of the page.

6.3.3 Headings

Tag	Description
<h1> - <h6>	It is used to define six levels of HTML headings (h1, h2, h3, h4, h5 and h6) with <h1> being heaviest heading and <h6> being the lightest heading.

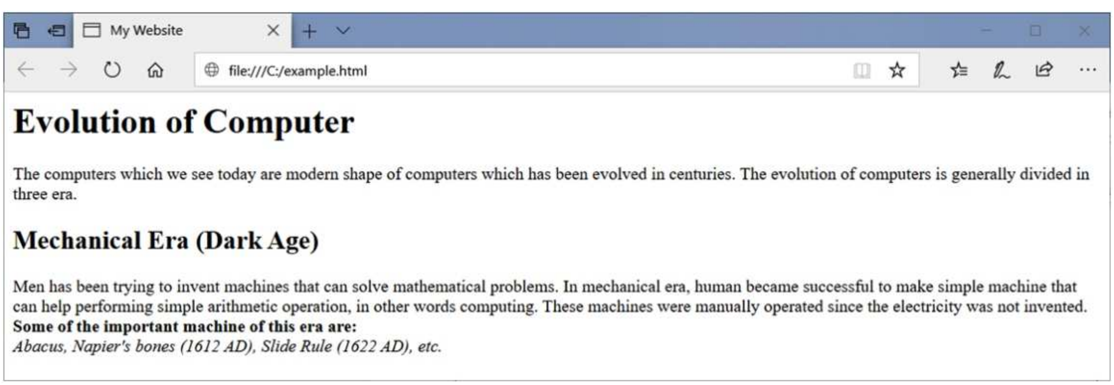
6.3.4 Text Formatting

Tag	Description
<b>, <i>, <u>	These tags are used to bold, italicize and underline text respectively.
<pre>	It is used to define a preformatted text. The web browser displays such text with spaces and line breaks as defined in HTML codes.
<font>	It is used to define the font, size and color of its text. This tag can be composed with three attributes: size, color and face. This tag is supported till version 4.1 of HTML.
<center>	It is used to align its text to the horizontal center of the web page. This tag is supported till version 4.1 of HTML.
<sub>	It defines subscript text which is under the baseline of other text and has a smaller size. e.g. H_2O
<sup>	It defines superscript text which is slightly above the normal line of other text and has a smaller size. e.g. $E=mc^2$

Example:

```
<html>
    <head>
        <title>My Website</title>
    </head>
    <body>
        <h1>Evolution of Computer</h1>
        <p>The computers which we see today are modern shape of com
puters which has been evolved in centuries. The evolution of comput
ers is generally divided in three eras.</p>
        <h2>Mechanical Era (Dark Age)</h2>
        <p>
            Men has been trying to invent machines that can solve
athematical problems. In mechanical era, human became successful to
 make simple machine that can help performing simple arithmetic ope
ration, in other words computing. These machines were manually oper
ated since the electricity was not invented.
            <br>
            <b>Some of the important machine of this era are: </b>
            <br>
            <i>Abacus, Napier's bones (1612 AD), Slide Rule (1622 A
D), etc.</i>
        </p>
    </body>
</html>
```

Output:



Teacher Note	Teachers should demonstrate practical application of common tags with their attributes

SLOs

- Differentiate among unordered list, ordered list, definition list and nested list
- Create unordered, ordered, definition and nested lists

6.4 CREATING LISTS

Lists are very useful in displaying point by point information such as to-do list, list of ingredients for a recipe, list of categories, etc. HTML provides three different types of list elements namely Unordered Lists, Ordered Lists and Description Lists. The web browsers automatically add indents, spaces and markers to HTML lists.

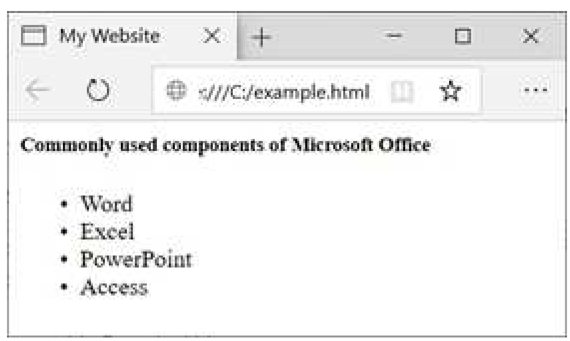
6.4.1 Unordered List

An unordered list is a list of related items in which the order of items is irrelevant. It is defined by <ul> tag and each of its list item is defined by <li> tag. The web browser will display these list items as bullet points.

Example:

```
<h5>Commonly used components of
 Microsoft Office</h5>
<ul>
    <li>Word</li>
    <li>Excel</li>
    <li>PowerPoint</li>
    <li>Access</li>
</ul>
```

Output:



6.4.2 Ordered List

An ordered list also displays a list of related items. It is used where the order of the list is important e.g. names of students in order of their exam ranks. It is defined by <ol> tag and each of its list item is defined by <li>. The web browser will display these list items with numbers starting from 1 instead of bullet points.

Ordered lists can also be defined with two of its attributes: start and reversed. Start attribute defines the starting number of first list item. Reversed attribute is used to display the list in descending order.

The list items for ordered list can also be defined with a value attribute which is used to place that item at a specific position or number in the list.

Example:

```
<h5>Steps to create HTML file </
h5>
<ol>
    <li>Text Editor</li>
    <li>New File</li>
    <li>HTML codes</li>
    <li>Save as .html</li>
</ul>
```

Output:



6.4.3 Description List

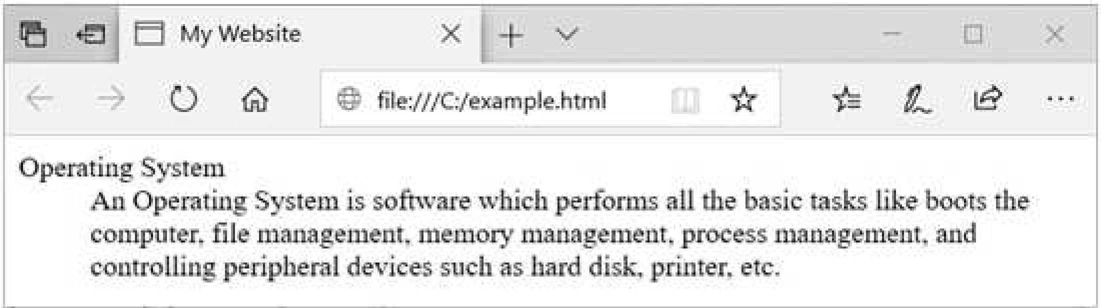
Description lists are used to display different terms and their descriptions just like in a dictionary or glossary. It is defined by `<dl>` tag and each of its list items is composed of two elements: term and description.

Term is defined by `<dt>` tag and its description is defined by `<dd>` tag. In description lists, a term can have one or more descriptions and a description can have one or more terms.

Example:

```
<dl>
    <dt>Operating System</dt>
    <dd>An Operating System is software which performs all the basic
 tasks like boots the computer, file  management, memory management,
process management, and controlling peripheral devices such as hard
disk, printer, etc.</dd>
</dl>
```

Output:



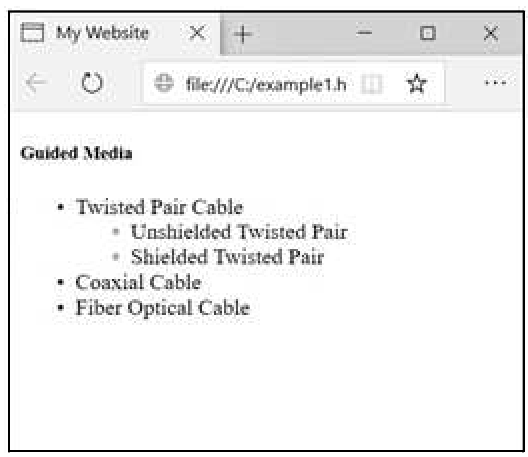
6.4.4 Nested Lists

A very powerful feature of HTML lists is their ability to nest one into another. Any of the list type can contain any other list type as its list item. It is defined by placing the new list tag inside the <li> tag of previous list. Web browsers automatically indent nested lists and assign appropriate marker to those nested list items as well.

Example:

```
<h5>Guided Media</h5>
<ul>
  <li>Twisted Pair Cable
    <ul>
      <li>Unshielded Twisted Pair</li>
      <li>Shielded Twisted Pair</li>
    </ul>
  </li>
  <li>Coaxial Cable</li>
  <li>Fiber Optical Cable</li>
</ul>
```

Output:



Teacher Note

Teachers are supposed to demonstrate use of various attributes of list elements.

SLOs

- Add an Image to a web page
- Apply Border to an Image in a web page
- Specify width and height of an Image
- Specify an alternate text for the image
- Apply background color to a web page
- Use and image as a background of web page

6.5 IMAGE AND BACKGROUND

Images and backgrounds give a visual appeal to the websites. Sometimes images can present a better understanding than long and uninteresting texts.

6.5.1 Images

Images can be inserted in an HTML document by using <img> tag. This does not create a copy of image. Instead, it only creates a reference to original image placed somewhere in the computer's storage.

The <img> tag is an empty tag which means that it does not require a closing </img> tag. It contains five attributes out of which two are required and three are optional.

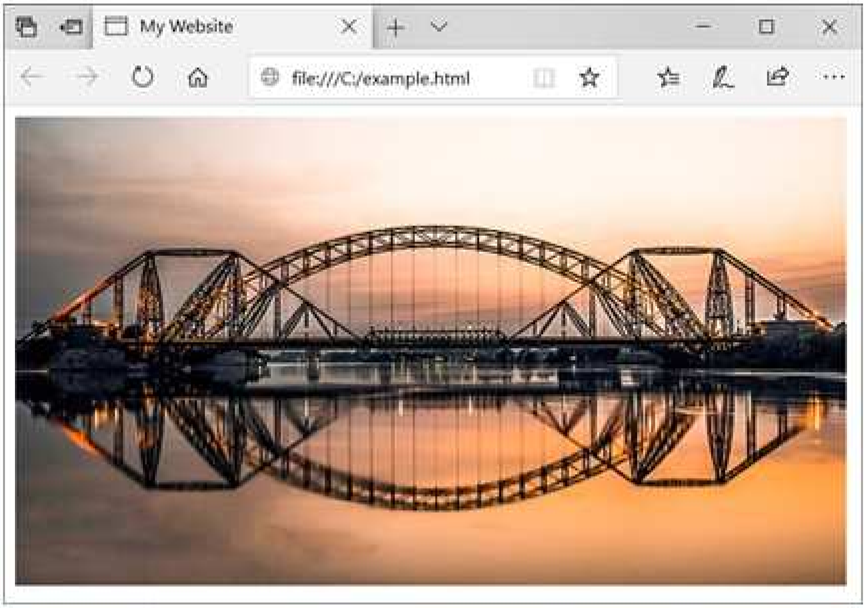
6.5.2 Attributes of Image Tag

Attribute	Value	Description
src	URL	Defines the source or reference of the image file. Syntax: <img src="image.jpg">
alt	text	Defines alternate text for the image. Syntax:<img src="image.jpg" alt="Introduction">
width	pixels	Defines the display width of the image. Syntax: <img src="image.jpg" width="300">
height	pixels	Defines the display height of the image. Syntax: <img src="image.jpg" height="120">
border	pixels	Defines the width of the border to be displayed around the image. (This attribute is supported till version 4.1 of HTML). Syntax: <img src="image.jpg" border="2">

Example:

```
<img src="bridge.jpg" alt="Bridge" width="600">
```

Output:



6.5.3 Backgrounds

The web browsers display an HTML document with white background by default. However, this can easily be changed to a different color or even an image with the help of bgcolor and background attributes of the <body> tag.

bgcolor: This attribute is used to change the color of the entire web page. Its color value can be defined as RGB code, hexadecimal code or by color name. For instance, to set the background color of the web page to green we can use any one of these values: rgb(0,255,0) : #00FF00 : green e.g. <body bgcolor=“green”>
background: This attribute is used to display an image as the background of the web page. Its value will be the reference or URL of the background image. e.g. <body background=“image.jpg”>

Both of these attributes are supported till version 4.1 of HTML.

SLOs

- Define a hyperlink
- Create a hyperlink to an external web page or within the same web page
- Develop the understanding about anchor tag
- Use different attributes of anchor tag

6.6 HYPERLINKS

Hyperlinks allow a user to navigate from one web page to another. It also enables users to navigate to different sections within the same web page. Hyperlinks convert text or other media into clickable objects.

6.6.1 Definition

A hyperlink in HTML is defined by <a> tag and its href attribute. The value of href is the reference of another web page or a different section within the same page.

- Links to external document: To send a user to any other web page, use the URL of that page as the value for href attribute.
  e.g.Goto Google
- Links within the same document: Setting the link within the same page requires two steps:
  1. Use id attribute of any HTML tag to give a name to the section of the page, where a user should reach after clicking on the link.
  2. Create a hyperlink and set the above name as href attribute of this link, starting with hash (#) symbol.
     e.g. <p id="navigate">Send user here on click</p>
     Go to the linked paragraph

Attribute	Value	Description
href	URL	Specifies the URL or section id of the page the link goes to.
name	Section Name	Specifies the name of an anchor. This attribute works till version 4.1 of HTML.
target	_blank : _parent : _self : _top : framename	Specifies where to open the linked document.

SLOs

- Define term table
- Differentiate between rows and columns
- Differentiate between table heading and table data tags
- Create a table in a web page
- Change horizontal and vertical alignment of cell contents
- Set the width of contents to specific number of pixels or percentage
- Draw a border around the table
- Control the distance between data in a cell using cell padding attribute
- Control space between adjacent cells using cells pacing attribute
- Create data cells that span given number of rows or column using colspan and rowspan attributes

6.7 TABLES

Tables allow displaying the content (like text, image, links) in the form of rows and columns. The coordinating place of a row with a column is called a cell. These cells contain some content of the webpage. In HTML, a table is defined by `<table>` tag.

6.7.1 Rows and Columns

A row is the collection of all horizontal cells of a table. A table can contain any number of rows. All the rows in a table have an equal number of cells. It is defined by `<tr>` tag which is placed inside the `<table>` tag.
A column is the collection of all vertical cells of a table. A table can contain any number of columns as well. It is defined by `<td>` tag which is placed inside the `<tr>` row tag.

6.7.2 Table Heading

HTML table allows defining a header for the columns of our table. A header cell is defined by `<th>` tag and is placed inside a `<tr>` row tag. It is used to differentiate from the content placed inside normal `<td>` data cells. To make the entire header row stand out from rest of the table contents, defined `<th>` tags for all columns of the first `<tr>` row tag of any `<table>` tag.

6.7.3 Table Data

The content is placed inside a cell in a table by using <td> table data tag. A cell can contain any type of data such as text, image, media, link, etc.

6.7.4 Table Attributes:

Attribute	Value	Description
align	left : center : right	Specifies the alignment of a table according to surrounding text.
width	pixels : %	Specifies the width of a table.
border	1 or 0	Enables or disables the border around the table.
cellpadding	pixels	Specifies the space between the edge of cell and the content inside.
cellspacing	pixels	Specifies the space between cells.

All the above attributes are supported till version 4.1 of HTML.

6.7.5 Cell Attributes:

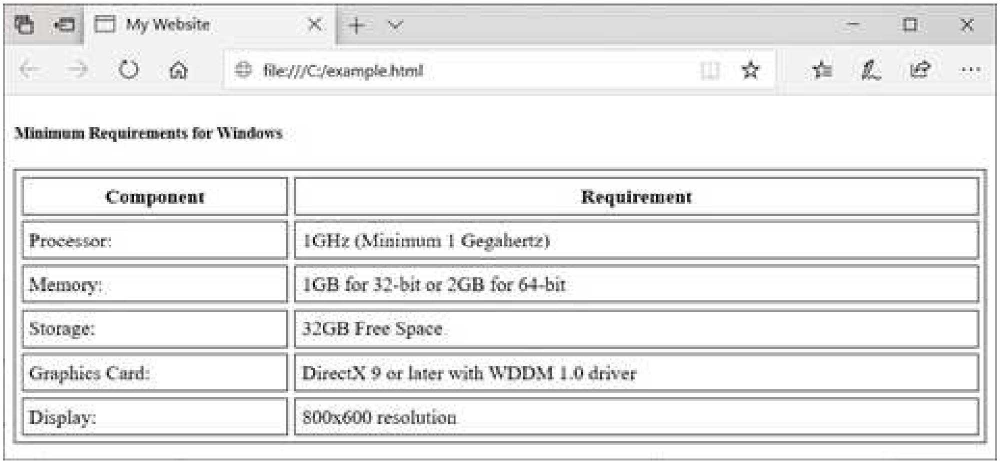
Attribute	Value	Description
align	left : center : right	Specifies the alignment of the content inside the cell.
valign	top : middle : bottom : baseline	Vertically aligns the content in a cell.
colspan	number	Specifies the number of columns a cell should merge into.
rowspan	number	Sets the number of rows a cell should merge into.

All the above attributes are supported till version 4.1 of HTML.

Example:

```
<h5>Minimum Requirements for Windows</h5>
<table width="100%" border="1" cellspacing="5" cellpadding="5">
  <tr>
    <th>Component</th>
    <th>Requirement</th>
  </tr>
  <tr>
    <td>Processor:</td>
    <td>1GHz (Minimum 1 Gegahertz)</td>
  </tr>
  <tr>
    <td>Memory:</td>
    <td>1GB for 32-bit or 2GB for 64-bit</td>
  </tr>
  <tr>
    <td>Storage:</td>
    <td>32GB Free Space</td>
  </tr>
  <tr>
    <td>Graphics Card:</td>
    <td>DirectX 9 or later with WDDM 1.0 driver</td>
  </tr>
  <tr>
    <td>Display:</td>
    <td>800x600 resolution</td>
  </tr>
</table>
```

Output:



Minimum Requirements for Windows

Component	Requirement
Processor:	1GHz (Minimum 1 Gegahertz)
Memory:	1GB for 32-bit or 2GB for 64-bit
Storage:	32GB Free Space
Graphics Card:	DirectX 9 or later with WDDM 1.0 driver
Display:	800x600 resolution

SLOs

- Define a frame
- Differentiate between a frame and a frameset
- Use rows and cols attributes of <frameset> tag to divide the browser screen into rows and columns
- Use different attributes like src, marginheight, marginwidth, name, noresize and scrolling of <frame> tag

6.8 FRAMES

HTML frames are powerful elements which allow displaying the contents of another HTML document within a web page. A web page can be divided into multiple sections and each section can display all contents from a different web page by using frames.

It is defined by <frame> tag. The src attribute is used to provide the reference URL of another web page to be displayed in this frame.

Attribute	Value	Description
src	URL	Defines the URL of the page which should be displayed in the frame.
marginheight	pixels	Defines top and bottom spaces of a frame.
marginwidth	pixels	Defines left and right spaces of a frame.
noresize	noresize	Defines if the user can change the frame size or not.
scrolling	yes : no : auto	Defines if the scroll bar should be displayed within the frame or not.

HTML frames and framesets are supported till version 4.1 of HTML.

6.8.1 Framesets

Framesets define how a web page is divided into rows and columns to display multiple frames on that web page. It is defined by <frameset> tag and contains one or more <frame> tags.

Attribute	Value	Description
cols	pixels : %	Defines the number and the size of frame columns.
rows	pixels : %	Defines the number and the size of frame rows.

SLO
- List out different website development tools.

6.9 WEB DESIGNING TOOLS

Following is the list of some of the tools that help in designing and developing a website:

- Microsoft FrontPage
- Coral Draw
- Adobe Dreamweaver
- Wordpress
- Microsoft Visual Studio
- Wix
- Figma
- CoffeeCup HTML Editor
- Adobe XD

SUMMARY

- WWW stands for world-wide web and is a way of accessing different websites through internet.
- There are multiple aspects involved in using accessing information through internet like Web Server, Web Hosting, Website and Web Browser.
- URL stands for Uniform Resource Locator and is the format in which external resources like web pages, images, other media and supporting files are referenced.
- There are different types of specialized websites such as Portal, News, Informational, Educational, Personal, Business, Blogs, Forums, Entertainment and Social.
- HTML is the language in which web pages are coded.
- Any text editor can be used to create HTML files however there are specialized editors also available.
- An HTML file must be of .htm or .html extension.
- A web browser is used to view HTML pages.
- The codes used in HTML are called tags and are denoted by angular brackets (<>).
- There are various HTML tags. Some define the appearance of the content. Some carry actual content such as text, images, videos, etc. Some provide additional information about the web pages.
- There are three kinds of HTML lists namely unordered list, ordered list and description list.
- Unordered lists display the list of items in which the sequential order of its items does not matter.
- Ordered lists display the items in numerically ordered sequence.
- Description Lists are less commonly used and are used to define terms and their descriptions such as in a dictionary.
- HTML lists can be nested into one another.
- HTML pages can make use of images to decorate and provide greater meaning to their content.

- Hyperlinks give the ability to any HTML object of being clickable. Hyperlinks provide means of navigation from one page to another or from one section in a page to another within the same page.
- HTML tables can be used to display data, information or content in a tabular format. Tables organize the content into rows and columns.
- HTML Frames can be used to display the entire contents of another web page within a web page.
- Framesets define the layout to display different frames and their contents.
- There are different tools available which facilitate the designing and development of web pages and websites.

EXERCISE

A. Choose the right answer:

1. The service that is responsible for making websites publicly accessible through the internet is called

   a) Web Server b) Web Hosting
   c) Web Site d) Web Browser

2. The type of special website where different users can ask questions and give answers or discuss on various topics is called:

   a) Social site b) Blogs site
   c) Forums site d) Informational site

3. Entertainment site specializes in delivering:

   a) News, weather and current affairs
   b) Information about products and services of a business
   c) Personal information of a particular person
   d) Content like videos, images and games for entertainment

4. A web browser will translate the codes in a web page if the extension of the document is:

a) .html
b) .txt
c) .doc
d) .pdf

5. The tag used to automatically add line space before and after the containing text is:

a) `<br>`
b) `<hr>`
c) `<p>`
d) `<pre>`

6. The type of list which shows its items in a numerically ordered sequence is:

a) Nested List
b) Unordered List
c) Ordered List
d) Description List

7. To create a clickable text which navigates to another page or section, we use:

a) `<input>` tag
b) `<li>` tag
c) `<b>` tag
d) `<a>` tag

8. To differentiate the heading cells from rest of the data in a table, we use:

a) `<th>` tag
b) `<tr>` tag
c) `<td>` tag
d) `<dt>` tag

9. The tag used to define the title caption of the web browser is:

a) `<thead>`
b) `<head>`
c) `<title>`
d) `<h1>`

10. The attribute used to define the URL for reference of image in <img> tag is:

a) target
b) name
c) src
d) href

B. Respond to the following:

1. Differentiate between web hosting and web server.
2. What are the steps involved in creating a complete website?
3. Differentiate between `<head>`, `<title>` and `<h1>` to `<h6>` tags.
4. Identify and explain some HTML tags used for formatting of the content.
5. Differentiate between ordered and unordered lists.
6. How are images displayed in an HTML page?
7. How can a user be redirected to another web page?
8. What kind of HTML elements are used to display data in rows and columns? Discuss some of its formatting features.
9. Is it possible to display the entire contents of another web page in our HTML page? How?
10. List some popular text editors and other tools which help in designing and development of websites.

C. Match the columns.

S.NO.	A	S.NO.	B	C
(i)	E-Commerce	(a)	Add navigation support to web pages	
(ii)	<head>	(b)	Organize information as list points	
(iii)	<dl>	(c)	Organize information in rows and columns	
(iv)	<tables>	(d)	Contains additional information and styling features of the web page	
(v)	<img>	(e)	Business website	
(vi)	Hyperlinks	(f)	Add images and infographics to the web page	

ACTIVITIES

Create three pages with following features:

Page 1 (home.html):

- Name of the file should be home.html
- Title of the page should be “Unit 6 – Activity – Home”
- Place a heading of “Input and Output Devices”
- Create an Unordered List with two items:
  - Input Devices
  - Output Devices
- Both of these items should be hyperlinks. Clicking on “Input Devices” should navigate to another html page named “inputs.html” and clicking on “Output Devices” should navigate to page named “outputs.html”

Page 2 (inputs.html)

- Title of the page should be “Unit 6 – Activity – Input Devices”
- The page should display a table with two columns:
  - Left column should contain names of different Input Devices
  - Right column should contain images for those input devices. The width of images should be set to 200 pixels.

Page 3 (outputs.html)

- Title of the page should be “Unit 6 – Activity – Output Devices”
- The page should display a table with two columns:
  - Left column should contain names of different Output Devices
  - Right column should contain images for those output devices. The width of images should be set to 200 pixels.

INTRODUCTION TO DATABASE SYSTEM

Unit 7



SLOs

- Define terms flat file system and database system
- Differentiate between flat file system and database system
- Discuss the advantages of database system over flat file system
- Differentiate between database and database management system (DBMS)

7.1 DATABASE

A database stores data in organized form. A database is composed of tables which contain rows and columns. These rows and columns are called records and fields respectively. Most databases contain multiple tables. For example, a general store database may include tables for purchase, sales and stock records. Each of these tables has different fields that are relevant to the information stored in the table. Generally, a database is an electronic system that facilitates easy access, manipulation and updating of data.

Use of Database

Nowadays, everyone is familiar with term database, it is mathematically developed data structure which converts raw input data into meaningful information for a particular organization. These days, database can be seen in every field of life, for example in industries, health, agriculture, schooling, business and banking.

The databases can be developed according to the size of its records for a particular organization. Databases can be small in size with a few records or very large like NADRA (National Database Registration Authority) databases which keep the multi millions of records.

A database is playing a leading role to enhance the efficiency and performance of any organization. The goal of database is to minimize the loss and increase the productivity and efficiency of any organization in the age of information technology.

7.1.1 Database Management System (DBMS)

Databases are usually developed, maintained and controlled by the Database Management System (DBMS). The DBMS essentially serves as an interface between databases and end users or application programs, ensuring that data is consistently organized and remains easily accessible.

Here are some examples of popular DBMSs used these days:

- MySql
- Oracle
- Microsoft SQL Server
- MongoDB
- Visual Foxpro
- IBM Db2
- PostgreSQL



Fig: 7.1 Popular DBMS

7.1.2 Flat File System

Early databases were relatively "flat", which means they were limited to simple rows and columns, like a spreadsheet. A flat file is the older version of database. It stores data in a single table structure. Flat file databases are usually in plain text format, with only one record per line. The fields included in the record are separated using delimiters such as tabs or commas.

7.1.3 Advantages of Database Management System over the Flat File System:

DBMS	Flat File System
Multiple users can access data simultaneously	Only one user can access at a time
Capable of handling huge sets of data	Suitable only for smaller sets of data
Allows non-duplication and integrity	Increases duplicate and redundant data
Supports online access	Does not support remote connections
Good for small, medium and large businesses	Limited only to smaller data management needs

Characteristics of Database Management System

A DBMS is modern version of database designing, organization and manipulation. This mainly offers the solutions which a flat file system could not provide. The DBMS has many characteristics. Some of them are:

- Multiple users can access DBMS and can view, add, edit and delete records.
- A DBMS offers tools like Queries, Views and Forms which help users to manipulate data easily and more efficiently.
- A DBMS is more secure and reliable.
- DBMS allows distribution of data in multiple tables by making use of features like keys and relationships between fields of those tables. This allows lesser duplication of data and results in lesser redundancy.
- Preparing backups and providing limited permissions to the users are features of DBMS.
- DBMS can handle large and complex data more conveniently. Therefore, it is preferred by the medium and large organizations.

SLO	• Define basic database terms like table, field, record, data type, etc.

7.2 BASIC COMPONENTS OF DBMS

The basic components of DBMS are discussed below:

(i) Table

It is a collection of data elements organized in shape of rows and columns. A contact list may be one of the simplest examples of a table. The marks record prepared by a class teacher is also an example of a table.

(ii) Field

It is the smallest component in a database. It is where the actual data is stored during data entry. All data fields in the same table, have unique names. Fields are also called attributes or columns. Multiple fields make up a data record, several data records make up a data table, and several data tables make up a database.

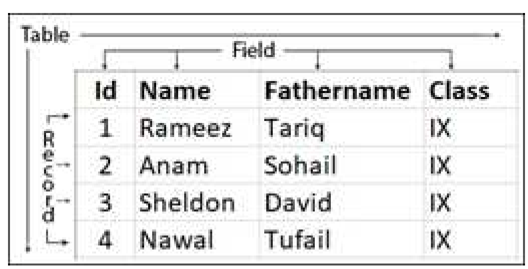


Fig: 7.2 Components of a Table

(iii) Record

A single entry in a table is called a record. Records are also referred as tuples or rows. A record is made up of two or several data items which are also called tuples in a table representing a set of related data. For example, the illustrated Student table (Fig: 7.2) has 4 tuples /records/rows.

(iv) Data Types

All fields in a table must have some data type. Data type is a data storage format that can contain a specific type or range of values. The data type of a field is a property that tells what kind of data that field can hold. Here are some basic data types.

Data Type	Description	Examples
Integer	Holds only whole numbers.	145, -35, 74586
Floating Point	Holds numbers with decimal points.	5.6, 3.14, 554.9
Character	Stores only one character.	A, B, c, d
String	Can store a combination of numbers, letters and special characters.	Pakistan, Computer, @admin
Boolean	Can hold only Boolean values i.e. true or false.	1,0
Date & Time	Stores date and time in specified format.	01-01-2020 11:30

Different DBMSs offer different range of data types to be stored. For example, MS Access allows a range of whole numbers from -32768 to 32767 for an "Integer". In modern DBMS, choosing proper data type is important to make sure that database runs faster.

Teacher Note	Teachers are advised to explain the concepts of data types and components of DBMS by demonstrating MS Access Components.

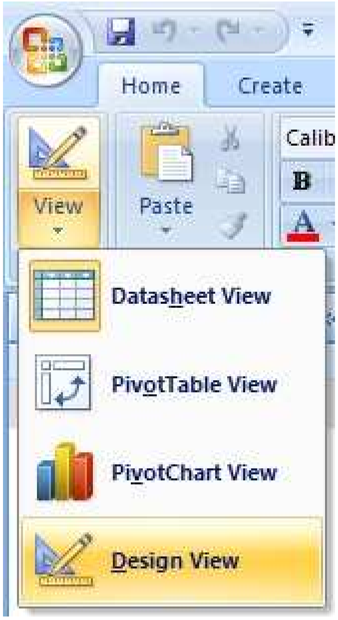
(v) Views

In a database the data is stored in tables. However, we can see that data through views. Views do not store data and just show the information virtually. They have the ability to fetch data from different tables. Views maintain the security of data and ensure that no changes occur in the original data.

Now we will learn how can we create Tables and Views in MS Access.

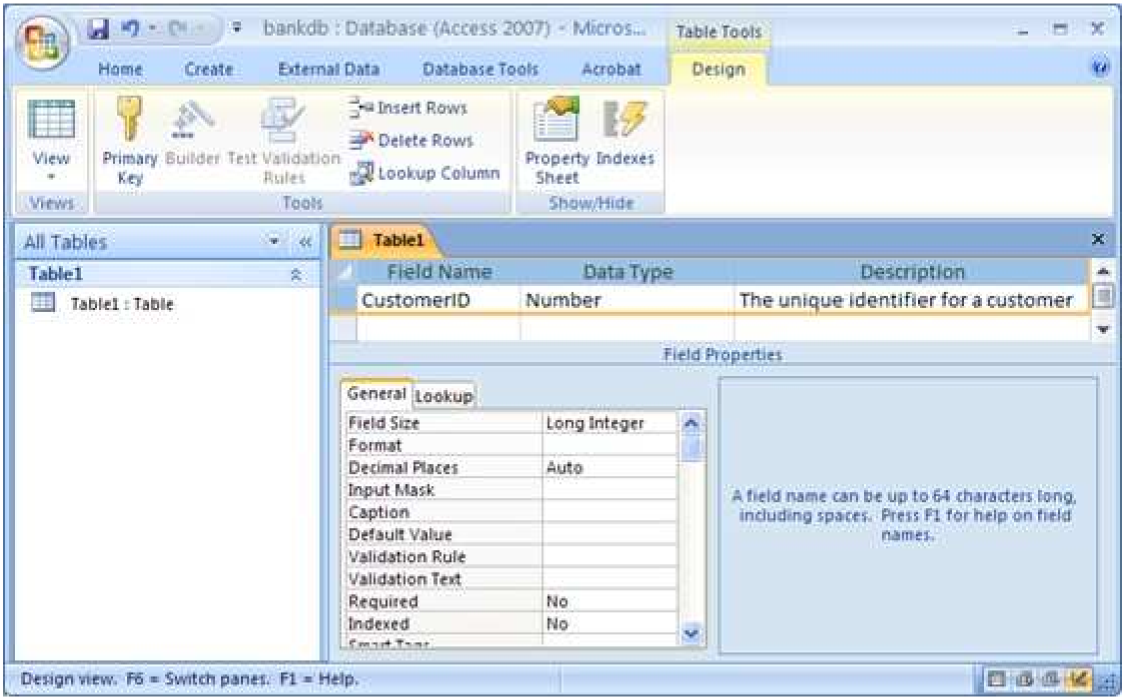
(i) Steps for creating a table using Design View:

1. To create tables in Access using "Design View," click on the Create tab and click on the Table icon. Then pull down the View menu and choose Design View.



2. A new table then appears in the Table Design View. Note that the default name assigned to the table is Table1.
3. Type the name of a field into the "Field Name" column.
4. Then use the drop-down menu in the "Data Type" column to assign the field a data type.

5. If desired, type a description of the data stored in this field.



6. Repeat steps 4 and 5 until you have created all of the necessary table fields. An example of a Table may be customer Table that has following entries.

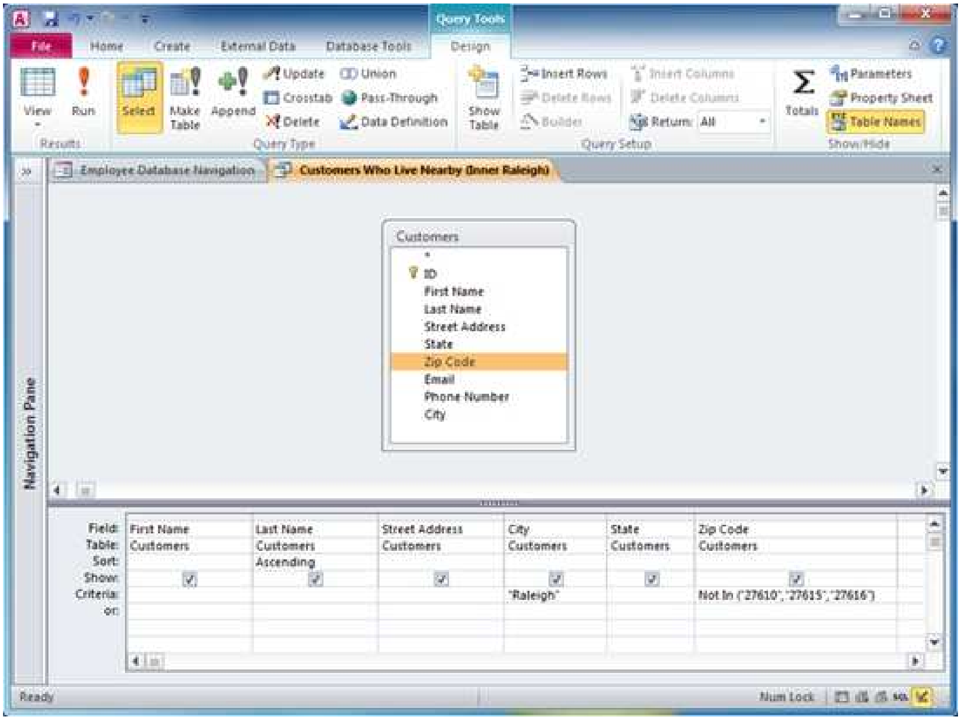
Field Name	Data Type	Description
Customer ID	Number	The Unique Identifier for a customer
First Name	Text	The First Name of the customer
Last Name	Text	The Last Name of the customer
Address	Text	The Address of the customer

7. Click the "Save" button in the Quick Access toolbar.
8. Then type a name for the newly created table and click "OK".



(ii) Steps for creating a query or view using Design View:

1. To make a query in design view, click on the "Create" tab in the Ribbon and pull down the "Queries" group and click on "Query Design" button.
2. In the "Show Table" dialog box, add the table or tables that you want to add to query design view.
3. Next, add the fields from these tables that you want to view in your query results or view. If you want to add all of the fields of a table into your result set, you can click and drag the first field in the table, shown as an asterisk.
4. Once you have added all the necessary tables and fields to the query or view, click the "Close" button in the "Show Table" dialog box to close it and display the query design view.
5. To run a query and view the result set, you can click the "Run" button in the "Results" group of the "Design" tab in the "Query Tools" contextual tab on the office Ribbon.
6. The result set looks like a table. This result set is a reflection of data from the selected fields of the tables. It is also known as a view.
7. Click the "Save" button in the Quick Access toolbar. Type a name for your view and click "OK" to save the query.



SLOs



- Define entity
- Discuss about the term relationship, in the context of database
- Distinguish among primary, foreign and referential keys

7.3 Data Modeling

Data modeling is a process of developing conceptual representation of data objects and their relations. Data models are used to express how the information will be stored in database. This helps to identify the most important fields and remove the irrelevant data. Data models can be used by database developers to create a physical database. This saves a lot of time and efforts of developers. There are three most important components of data models.

(i) Entity

(ii) Relationship

(iii) Referential Keys

7.3.1 Entity

In literal sense, an entity is any individual object which has its own qualities and properties. In database terms, an entity is an independent table and its fields are known as attributes. As an example, a Payroll database will contain an entity named Employees. The Employees entity will contain various attributes like EmployeeID, Name, Designation, Salary, etc.

7.3.2 Relationship

When the database structures grew and became more complex, a lot of data started to become redundant which means that data was being unnecessarily duplicated. This created a need to connect data entities instead of repeating same data in multiple tables. This resulted in the creation of relationships and Relational Database Management Systems (RDBMS).

A relationship defines the connection between two tables. It creates a connection from an attribute of one entity with an attribute of another entity. Three types of relationships can be defined between entities.

(i) One to One Relationship

This type of relationship defines that a record in one entity can be connected to only one record in another entity. This is not a very common type of relationship because the data from related entities can directly be placed in a single entity. However, this type of relationship is used to divide larger entities into smaller ones.

(ii) One to Many Relationship

This type of relationship defines that a record in one entity can be connected to many records in another entity. This is the most common type of relationship used in relational databases. This relationship can also be seen as *Many to One Relationship*.

(iii) Many to Many Relationship

In this type of relationship, one or more records of one entity are connected to one or more records of another entity. Usually, a third entity known as “junction table” is used to create the many-to-many relationship between two related entities.

7.3.3 Referential Keys

The relationships are configured by using referential keys on entities. The keys determine a certain set of rules that must be followed by the data stored in a field of an entity. In larger databases, keys are very important to uniquely identify a specific record. Two types of keys are most commonly used in RDBMSs:

(i) Primary Key

A primary key is used to uniquely identify a record in an entity. When a primary key is applied to any attribute in an entity, it forces the rules of Primary Key onto that attribute. These rules are:

- The attribute (field) must contain a unique value to identify a record. A unique value means that two records in the same entity cannot have the same value stored in this attribute where Primary Key is applied.
- The value of the attribute where Primary Key is applied, cannot be null.

(ii) Foreign Key

A foreign key is used to define the connection or relation between two entities. The foreign key of one entity is configured to be connected to the primary key of another entity. When a foreign key is applied on an attribute, it enforces that the value for that attribute should match any record in the related entity having a primary key.

Understanding relationship and referential keys:

The figure 7.3 shows four tables and their fields.

Students table is used to store personal information of individual student. It has an Id field set as a Primary Key. It also has a ClassId field to setup a One-to-One foreign key relationship with the Class table.

Class table is used to store information about classrooms in a school. It has an Id field set as a Primary Key. A student can be enrolled in only one class; hence, Students table has a One-to-One relationship with Class table. However, many teachers can be associated with many classes. This requires a Many-to-Many relationship between Class and Teachers tables.

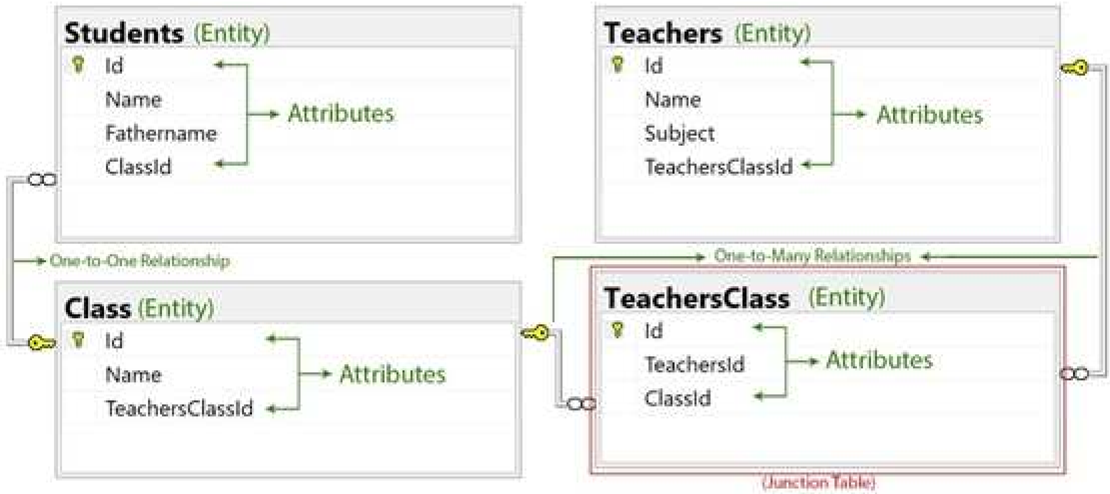


Fig: 7.3 Entity Relationship Diagram

Teachers table is used to store personal information about a teacher. It has an Id field set as a Primary Key. Many classes can be taught by many teachers. This requires a Many-to-Many relationship between Teachers and Class tables.

TeachersClass table is used as a junction table to facilitate the Many-to-Many relationship between Teacher and Class tables. It also contains an Id field set as Primary Key. The other two fields are used to define which teachers are associated with which classes. It creates a One-to-Many relationship with each of the two connected tables. Teachers and Class tables use their TeachersClassId field's foreign key relationship to fetch the related information from this table.

SLOs

- Define term ER model
- Design ER model for a database in M.S Access

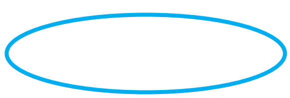
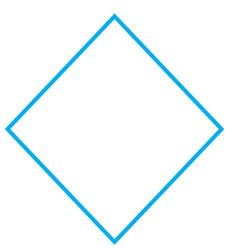
7.3.4 Entity Relationship or ER Model

Entity Relationship Model (ERM) or Entity Relationship Diagram (ERD) describes the entities, attributes and relationships with their types in a simplified diagram. This model or diagram can itself be used as the reference for designing an actual database. It can even be used as a backup for the structure of a database. The ERD can be used in two ways:

- When the database has not been created yet. The ERD helps in creating a clear representation of the entire database based on user requirements.
- When an existing database needs to be documented. The Database development tool features automatic creation of ERD based on existing database which facilitates documentation.

(i) Components of ER Diagram

ER Design is made up of different components like Attributes, Relationships, etc. There are defined symbols and shapes to represent each one of them. Some of the shapes used to define these components are:

	A rectangle is used to define an **entity**. This can be any real-world object like Student, Teacher, Class, etc.
	An ellipse defines an **attribute** of an entity. One entity may contain multiple attributes and are defined by multiple ellipses.
	**Relationships** are symbolically represented by diamond shape. It simply states the type of relationship between two entities.
	Connecting lines show the **type of relationship** between two entities. These lines are annotated by 1 or M (stands for Many) at their ends to describe the type of relationship.

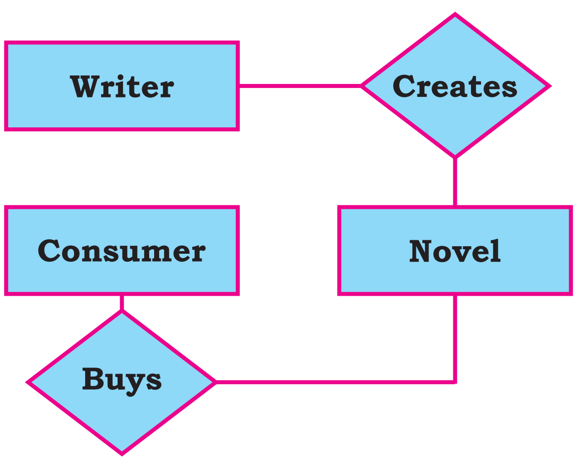
(ii) Steps to design ER Model

1. Identify and design the entities based on the requirements of its users.
2. Identify and design the attributes within the required entities.
3. Identify the relationships required between entities.
4. Define Primary Keys in interrelated entities.
5. Design Foreign Key relationships based on requirements and bind them to previously created Primary Keys.
6. Generate an automated Entity Relationship Diagram

For example a sample ERD for the statement "A writer creates a novel and consumer buys novel" is discussed below.

Here in this example, diagram shows that:

- Entities are in rectangular Box
  1. Writer
  2. Consumer
  3. Novel
- Relationships are in Diamond Shape
  1. Create
  2. Buys



Teacher Note	Teachers are expected to help students in designing an ER Model as given in the Activity section.

SUMMARY

- A database stores data in an organized form.
- Databases are used in many different organizations and various industries.
- A Database Management System (DBMS) software allows convenient creation, modification and display of data in a database.
- There are many popular DBMS programs such as Microsoft SQL, MySQL, Oracle, etc.
- The data in a flat file database is limited to rows and columns in a table.
- Flat file databases usually store data as plain text.
- A DBMS can handle huge sets of data and has multi-user support.
- The fields in a table can be defined as one of the supported data types which best suits the type of data it holds.
- A Relational DBMS introduces concepts of entities, attributes, relationships and keys.
- A table is also called an entity, a record is also called row or tuple and a field is also called an attribute or column.
- There are essentially two types of relationships: One-to-One relationship and One-to-Many relationship.
- One-to-One relationship relates a record from one entity to only one record of another entity.
- One-to-Many relationship relates a record from one entity to one or more records of another entity.
- Many-to-Many relationship is a combination of two One-to-Many relationships with the help of a junction table.
- Relationships make use of Keys.
- Two common types of keys are Primary Keys and Foreign Keys.
- Primary key uniquely identifies records in an entity.
- Foreign key defines a relationship between two entities.
- Entity Relationship Model (ERM) or Entity Relationship Diagram (ERD) graphically displays the structure of a database.
- The components of ERD include Entities, Attributes and Relationships.
- ERDs are used to either design a new database or document an existing one.

EXERCISE

A. Choose the right answer.

1. Which of the following Microsoft Office packages is a DBMS?
   a) MS- Word b) MS- Excel
   c) MS- Power Point d) MS- Access

2. The basic limitation of a flat file database is that:
   a) It is complicated b) It stores data in a single file
   c) It is very heavy d) It is not supported on internet

3. In a database table of "Students", the address of the student will be a:
   a) Record b) Field
   c) Entity d) Data type

4. In a database table of "Students", the particulars of a single student will be a:
   a) Record b) Field
   c) Entity d) Data type

5. In a relational database, keys are used to create a:
   a) Table b) Fields
   c) Records d) Relationship

6. A field that stores the names of students should be defined as:
   a) Integer b) Float
   c) String d) Boolean

7. A key that allows only unique entries in a field is called:
   a) Primary Key b) Secondary Key
   c) Foreign Key d) Super Key

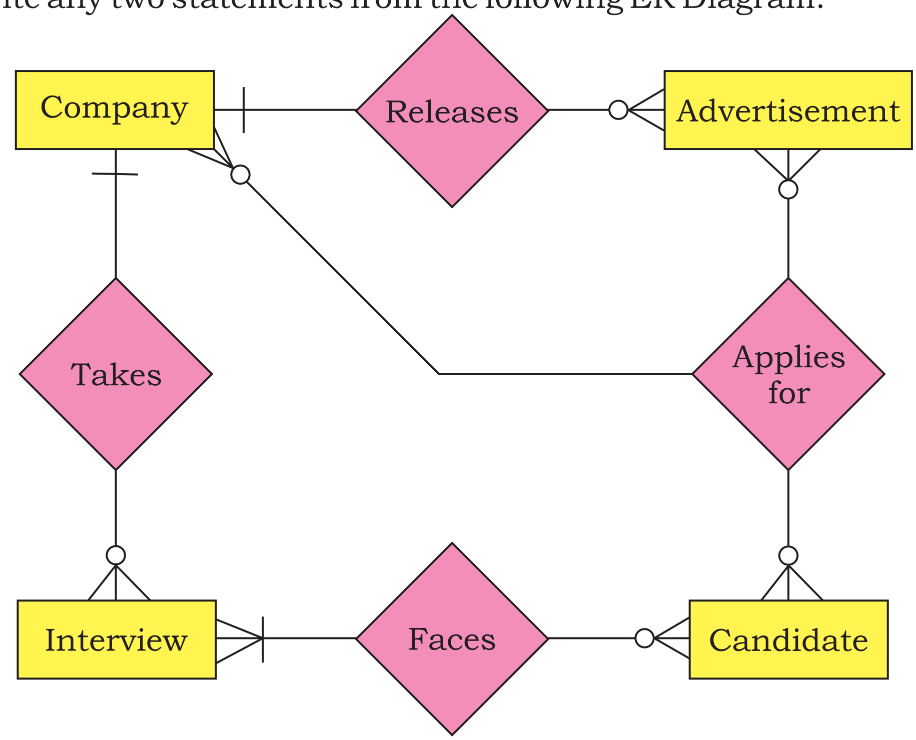
8. Data Redundancy means:
   a) Duplication of Data b) Variety of Data
   c) Size of Data d) Data Type

9. The relationship that matches one record of an entity with only one record of another entity is called:
   a) One-to-One relationship b) One-to-Many relationship
   c) Many-to-One relationship d) Many-to-Many relationship

10. The shape that is used to represent an attribute in an ERD is:
   a) A diamond b) An octagon
   c) A rectangle d) An ellipse

B. Respond the following:

1. Why Database Management System is preferred over Flat File System?
2. Discuss the use of databases in business with example.
3. What is the difference between Design View and Datasheet View?
4. Why is it important to carefully decide the data type for each field?
5. What is the difference between table and view?
6. Explain entities, attributes and relationships with one example of each.
7. List the major characteristics of primary and foreign keys.
8. Write three benefits of using relationships in the database.
9. Discuss the importance of ERD in business
10. Write any two statements from the following ER Diagram.



C. Match the columns:

S.NO.	A	S.NO.	B	C
(i)	Primary Key	(a)	Attributes	
(ii)	Integer data	(b)	Always unique value in field	
(iii)	Relationship	(c)	Data in plain text form	
(iv)	Field	(d)	Number without decimal point	
(v)	View	(e)	Connection between two tables	
(vi)	Flat file system	(f)	Shows virtual data	
(vii)	Entity	(g)	Table with its own attributes	

ACTIVITIES

1. Create few tables and practice; adding, updating and deleting records in MS Access.
2. Create a table in MS Access by importing Excel Sheet. Examine the data type of each field after importing. Make changes in data types where it is required.
3. Create different views to show data from two tables.
4. In supervision of your teacher, draw a simple ERD on paper and implement that in MS Access. Your ERD should include at least three entities, list of attributes of each table, proper data type assignment for each field, implementation of primary and foreign keys and simple relationships between entities.

WEBLINKS/ WEBSITES

Dear learners!

Internet is full of resources and it is ever growing at very fast speed. Here are some links of website and videos which may help to improve your understanding regarding the concepts that you learn in this book. Remember, these are just few examples. You and your teachers can find many other resources on web.

Fundamental of Computers	➢ https://www.javatpoint.com/history-of-computer ➢ https://www.edureka.co/blog/types-of-artificial-intelligence/ ➢ https://www.tutorialandexample.com/computer-fundamentals-tutorial/
Fundamental of Operating Systems	➢ https://edu.gcfglobal.org/en/computerbasics/understanding-operating-systems/1/ ➢ https://www.dell.com/support/article/en-pk/sln288177/how-to-install-windows-8-or-windows-10-on-a-system-that-was-factory-downgraded-to-windows-7?lang=en
Office Automation	➢ https://www.youtube.com/watch?v=fUkh3yWm3d4 ➢ https://edu.gcfglobal.org/en/excel2010/
Data Communication and Computer Networks	➢ https://www.studytonight.com/computer-networks/ ➢ https://www.ece.uvic.ca/~itraore/elec567-13/notes/dist-03-4.pdf ➢ https://www.youtube.com/watch?v=gFTyL4ZvS5s
Computer Security and Ethics	➢ https://www.reveantivirus.com/en/computer-security-threats/computer-hacking ➢ https://copyrightalliance.org/ca_faq_post/difference-copyright-patent-trademark/ ➢ http://www.nr3c.gov.pk/rescue9911.html ➢ http://web.cs.unlv.edu/harkanso/cs115/files/14%20-%20Computer%20Security.pdf

Web Development	➢ https://www.w3schools.com/html/html_intro.asp ➢ https://www.youtube.com/watch?v=ABFi5V7AiXQ
Introduction of Database System	➢ https://www.studytonight.com/dbms ➢ https://www.tutorialspoint.com/dbms/er_model_basic_concepts.htm
General Websites	➢ https://www.webopedia.com ➢ https://www.unm.edu/~tbeach/terms/index.html ➢ https://www.edureka.co ➢ https://www.britannica.com/ ➢ https://edu.gcfglobal.org/en/computerbasics/ ➢ https://www.homeandlearn.co.uk/BC/BeginnersComputing.html

List of lab activities for grade 9

(Practical)

As given in curriculum

1. Operating System

- Installation of O.S. (MS Windows latest version)
- Manage files and folders
- Customize desktop
- Installation of MS Office latest version
- Installation of Antivirus Software

2. MS Word

- Write different applications / letters
- Design class time table
- Design greeting / invitation cards
- Design certificates

3. Spread Sheet

- Create a marksheet
- Create a utility bill
- Monthly attendance record
- Create a Stock Control list for a grocery shop

4. Create a webpage / website involving

- Lists
- Images and backgrounds
- Hyperlinks
- Tables
- Frames